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MODEL 143
20 MHz FUNCTION GENERATOR

VIKING LABORATORIES INC.

WAVETEK

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INSTRUCTION MANUAL

MODEL 143
20 MHz FUNCTION GENERATOR

VIKING LABORATORIES INC.

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SAFETY

This instrument is wired for earth grounding via the facility power wiring. Do not bypass earth grounding with two wire extension cords, plug adapters, etc.

BEFORE PLUGGING IN the instrument, comply with installation instructions.

MAINTENANCE may require power on with the instrument covers removed. This should be done only by qualified personnel aware of the electrical hazards.

WARNING notes call attention to possible injury or death hazards in subsequent operations.

CAUTION notes call attention to possible equipment damage in subsequent operations.

SECTION 1
GENERAL DESCRIPTION

1.1 THE MODEL 143

The Model 143 20 MHz Function Generator is a precision source of sine, triangle and square waveforms, negative and positive pulses and dc levels. All are front panel and external control variable from 0.0001 Hz to 20 MHz and can be modulated, swept or dc controlled over a 1000:1 range by an external voltage. Output can be continuous or the generator can be triggered or gated by an external voltage or front panel switch.

The waveform amplitude can be varied up to 30 volts peak-to-peak (open circuit) and attenuated up to 80 dB. Pulse amplitude can be varied from ±15 volts peak (open circuit). DC voltage or dc offset of signal is variable by front panel control and by external control between ±15 volts (open circuit). Waveform symmetry is variable from 19:1 to 1:19 for control of duty cycle and ramp rise/fall times. Triggered waveform start/stop point is adjustable for creation of special waveforms such as the haversine. A voltage representing generator frequency and a TTL level sync pulse at the frequency of the generator are auxiliary outputs.

1.2 SPECIFICATIONS

1.2.1 Versatility

Waveforms
Selectable sine ∿ , square ⊓ , triangle ∧ , positive square ⎍ , negative square ⎎ , TTL sync pulse and dc. Symmetry of waveforms may be varied for sawtooth and variable duty cycle pulses.

Operational Modes
Continuous: Generator oscillates continuously at selected frequency.

Triggered: Generator is quiescent until triggered by an external signal or manual trigger, then generates one cycle at selected frequency.

Gated: As triggered mode, except generator oscillates for the duration of the gate signal.

Frequency Range
0.0001 Hz to 20 MHz in 10 overlapping ranges with 1% vernier control.

Function Output
∿, ⊓, ∧ selectable and variable to 30V p-p (15V p-p into 50Ω). ⎍ , ⎎ , to 15 Vp (7.5 Vp into 50Ω). All waveforms and dc can supply 150 mA peak current and may be attenuated to 60 dB in 20 dB steps with an additional 20 dB vernier.

DC Output and DC Offset
Selectable thru FUNCTION OUT output. Controlled by front panel control or by applying an external voltage. Adjustable between ±15 Vdc (±7.5 Vdc into 50Ω) with signal peak plus offset limited to ±15 Vdc (±7.5 Vdc into 50Ω). External offset sensitivity approximately −1 V/V with output into open circuit. DC offset and output waveform attenuated proportionately by the 60 dB output attenuator.

Sync Output
A TTL level pulse. Will drive 50Ω termination.

GCV — Generator Controlled Voltage
At GCV OUT connector, a 0 to +2V signal proportional to generator frequency. 600Ω source impedance.

VCG — Voltage Controlled Generator
Up to 1000:1 frequency change with external 0 to 2 volt signal to VCG IN connector. Upper and lower frequencies limited to maximum and minimum of selected range.
Slew rate: 2% of range per μs.
Linearity:
±0.2% for 10 Hz to 100 kHz.
±0.75% for 0.001 Hz to 2 MHz.
Input Impedance: 2 kΩ.

Trigger and Gate
Input Range: 1V p-p to ±10V.
Impedance: 10 kΩ, 33 pF.
Pulse Width: 25 ns minimum.
Repetition Rate: 10 MHz maximum.
Adjustable Triggered Signal Start/Stop Point (sine and triangle only): Approximately −90° to +90° to 2 MHz.

Symmetry
Symmetry of all waveform outputs is continuously adjustable from 1:19 to 19:1. Varying symmetry provides variable duty cycle pulses, sawtooth ramps and distorted sine waves.

NOTE

When SYMMETRY control is used, indicated frequency is divided by approximately 10.

1.2.2 Frequency Precision

Dial Accuracy
±3% of full range from X .01 Hz to X 1 MHz.
±5% of full range on X 10 MHz.

Time Symmetry
Square wave variation less than:
±1% from 0.001 Hz to 200 kHz
±0.5% from 20 Hz to 20 kHz

1.2.3 Amplitude Precision

Amplitude Change With Frequency
Sine variation less than:
0.1 dB for 0.001 Hz to 200 kHz
0.5 dB for 200 kHz to 2 MHz
3.0 dB for 2 to 20 MHz

Step Attenuator Accuracy
0.3 dB per 20 dB step at 2 kHz.

1.2.4 Waveform Characteristics

Sine Distortion
< 0.5% on X 100 Hz to X 10 kHz.
< 1.0% on X .01 to X 10 Hz and X 100 kHz.
All harmonics 34 dB below fundamental on X 1 MHz.
All harmonics 26 dB below fundamental on X 10 MHz.

Square Wave Rise/Fall Times
At FUNCTION OUT < 20 ns for 15V p-p output into 50Ω load.

1.2.5 General

Stability
Short Term: ±0.05% for 10 minutes.
Long Term: ±0.25% for 24 hours.
Percentages apply to amplitude, frequency and dc offset.

Environmental
Specifications apply at 25°C ±5°C. Instrument will operate from 0°C to 50°C ambient temperatures.

Dimensions
28.6 cm (11¼ in.) wide; 14.5 cm (5¾ in.) high; 27.3 cm (10¾ in.) deep.

Weight
5 kg (11 lb) net; 6.6 kg (14½ lb) shipping.

Power
90 to 105V, 108 to 126V, 198 to 231V and 216 to 252V selectable; 48 to 400 Hz; less than 30 watts.

NOTE

All specifications apply from 10 to 100% of a selected frequency range, when FUNCTION OUT is at maximum and 50Ω terminated, with SYMMETRY control at OFF. Symmetry and vernier affect frequency calibration. Maximum possible asymmetry is a function of frequency setting.

SECTION 2
INSTALLATION

2.1 MECHANICAL INSTALLATION

After unpacking the instrument, visually inspect all external parts for possible damage to connectors, surface areas, etc. If damage is discovered, file a claim with the carrier who transported the unit. The shipping container and packing material should be saved in case reshipment is required.

2.2 ELECTRICAL INSTALLATION

2.2.1 Power Connection

WARNING

To preclude injury or death due to shock, the third wire earth ground must be continuous to the facility power outlet. Before connecting to the facility power outlet, examine extension cords, autotransformers, etc., between the instrument and the facility power outlet for a continuous earth ground path. The earth ground path can be identified at the plug on the instrument power cord; of the three terminals, the earth ground terminal is the nonmatching shape, usually cylindrical.

CAUTION

To prevent damage to the instrument, check for proper match of line and instrument voltage and proper fuse type and rating.

NOTE

Unless otherwise specified at the time of purchase, this instrument was shipped from the factory with the power transformer connected for operation on a 108 to 132 Vac line supply and with a 0.5 amp slow blow fuse.

Conversion to other input voltages requires a change in rear panel fuse-holder voltage card position and slow blow fuse according to the following table and procedure.

Card Position	Input Vac	Fuse
100	90 to 105	0.5 amp
120	108 to 126	0.5 amp
220	198 to 231	0.25 amp
240	216 to 252	0.25 amp

1. Open fuse holder cover door and rotate fuse pull to left to remove the fuse.
2. Select operating voltage by orienting the printed circuit board to position the desired voltage on the top left side. Push the board firmly into its module slot.
3. Rotate the fuse-pull back into the normal position and insert the correct fuse into the fuse holder. Close the cover door.
4. Connect the ac line cord to the mating connector at the rear of the unit and the power source.

2.2.2 Signal Connections

Use 3 foot RG58U 50Ω shielded cables equipped with female BNC connectors to distribute all input and output signals.

2.3 ELECTRICAL ACCEPTANCE CHECK

This checkout procedure is a general verification of generator operation. Should a malfunction be found, refer to the warranty in the front of this manual.

A two channel oscilloscope, four 3 foot 50Ω coax cables with female BNC connectors, a coax tee connector and a function generator are required for this procedure.

Preset the generator front panel controls as follows:

Control	Position
Dial	1.0
GENERATOR MODE	CONT
TRIGGER LEVEL	9 o'clock
TRIGGER START/STOP	0° CAL
ATTENUATION	0
ATTENUATION VERNIER	Full cw
FUNCTION	⎍
DC OFFSET	OFF
SYMMETRY	OFF
FREQUENCY MULT	1K
VERNIER	Full cw

Set up the oscilloscope, Model 143 and external generator as shown in figure 2-1.

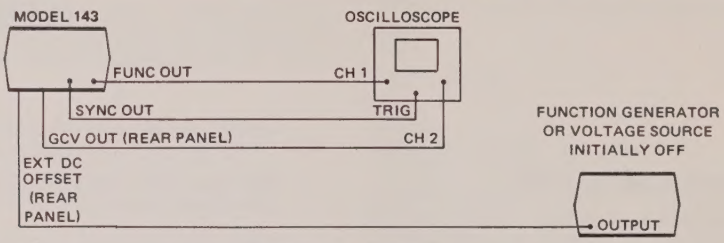


Figure 2-1. Initial Setup

Table 2-1. Acceptance Procedure

Step	Control	Position/Operation	Observe
1	POWER	ON	1 kHz square wave.
2	Dial	Rotate dial. Return to 1.0.	Rotation ccw increases frequency of square on one channel and dc level on other channel; cw decreases frequency and dc level.
3	FREQUENCY MULT	Rotate switch. Return to 1K.	Rotation cw increases frequency; ccw decreases frequency (dc level not affected).
4	VERNIER	Rotate ccw. Return to CAL.	Rotation ccw gives a small decrease in frequency.
5	ATTENUATION	Rotate ccw. Return to 0.	Rotation ccw reduces square wave amplitude.
6	ATTENUATION VERNIER	Rotate ccw.	Square wave amplitude decreases.
7	DC OFFSET	Rotate cw. Return to OFF.	Square wave is immediately offset below previous level; then waveform moves up to a positive level. OFF returns waveform to original position. (Clipping occurs at ±15V.)
8	Function Generator or Voltage Source	Vary input voltage.	Waveform dc level varies.
	Remove EXT DC OFFSET IN cable and connect to VCG IN connector. Remove GCV OUT cable.		
9	Function Generator or Voltage Source	Vary input voltage; then disconnect input.	Frequency increases with increased voltage, decreases with decreased voltage.
10	ATTENUATION VERNIER	Rotate cw.	– – –
11	FUNCTION	Rotate to DC, ∿, ∿, ⊓, ⊓, ⊔, then ∿.	Note dc level on scope. ∿, ∿ and ⊓ should be centered on dc level. ⊓ should rest on dc level, ⊔ should rise to dc level.
12	SYMMETRY	Rotate cw, then to OFF.	Waveform changes from ∿ to ⩘ to ⩘ and frequency decreases, then to ∿ at original frequency.

Table 2-1. Acceptance Procedure (Continued)

Step	Control	Position/Operation	Observe
13	GENERATOR MODE	GATE	A dc level.
14	MANUAL TRIG	Press down.	A series of sine waves.
	Set up a trigger source as shown in figure 2-2. Trigger on triangle waveform. Set trigger source at 100 Hz ^V .		
15	TRIGGER LEVEL	Rotate knob. Set for several cycles.	Knob varies number of cycles gated.
16	GENERATOR MODE	TRIG	One cycle per trigger cycle.
17	TRIGGER START/STOP	Rotate knob, then to 0° CAL.	CW starts sine wave at +90°; ccw starts sine wave at −90°. Fully cw gives continuous sine waves.

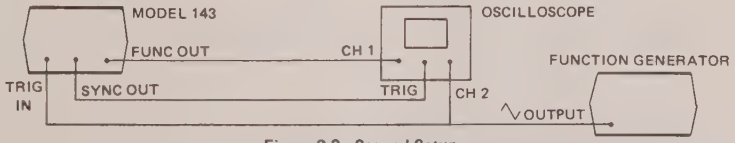


Figure 2-2. Second Setup

3.1 CONTROLS AND CONNECTIONS

The generator front panel controls and connectors are shown in figure 3-1 and keyed to the following descriptions.

(1) **POWER Switch**

Turns generator on and off.

(2) **Frequency Dial**

Settings under the dial index mark multiplied by (14) determine the output signal frequency. The frequency can be varied by the vernier (14) and the VCG signal (13) .

(3) **GENERATOR MODE Switch**

Selects one of the following three modes.

CONT – Continuous output at FUNCTION OUT, and SYNC OUT connectors.

TRIG – DC level output at both output connectors until the generator is triggered by MANUAL TRIGGER switch or with a signal at the TRIG IN connector. When triggered, the generator output is one cycle of waveform or one pulse period followed by a dc level.

GATE – As for TRIG except the output is continuous for the duration of the trigger signal at TRIG IN. The last cycle or period started is completed.

TRIGGER LEVEL Control

Determines the level at which the input trigger signal at the TRIG IN connector (12) is accepted

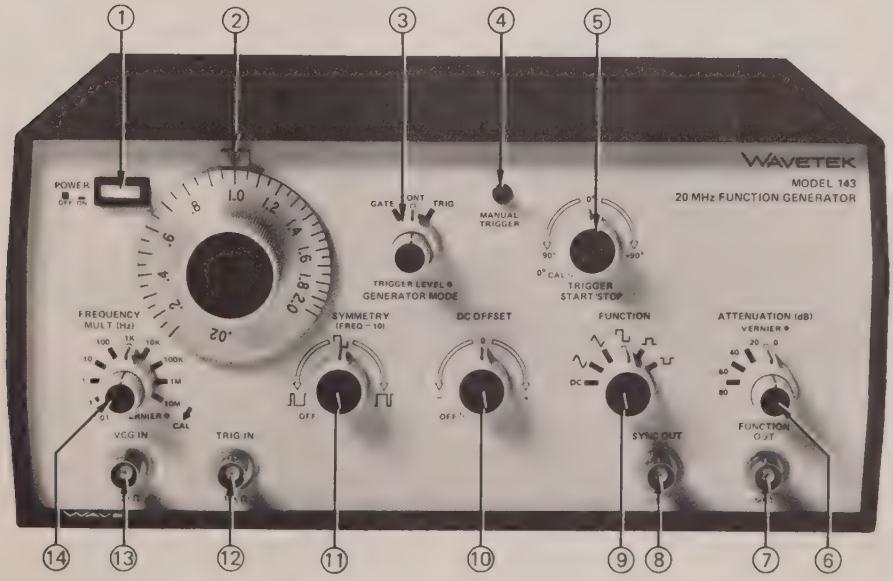


Figure 3-1. Controls and Connectors

as a trigger or gate in the trigger and gate modes. The trigger level can be varied from fully cw, where a positive-going excursion thru approximately −10V is a trigger, to fully ccw, where a positive-going excursion thru approximately +10V level is a trigger.

④ **MANUAL TRIGGER Switch**

Triggers or gates the output signal when GENERATOR MODE switch ③ is at TRIG or GATE. In trigger mode, one cycle is output when the switch is pressed. In gate mode, cycles are continuously output as long as the switch is held down.

NOTE

Set TRIGGER LEVEL ③ fully ccw.

⑤ **TRIGGER START/STOP Control**

Sets the start and stop point of the sine or triangle waveform appearing at ⑦. Usually used in the trigger mode and in combination with ⑩ to create desired waveforms. 0° CAL position ensures conventional waveforms symmetrical about 0 Vdc.

⑥ **ATTENUATION Control**

Outer knob reduces output voltage level of all output at FUNCTION OUT with increasing steps of attenuation.

VERNIER Control

Inner knob is a 20 dB vernier which controls the output within the steps of the outer knob. DC and offset voltages are not affected by this control.

⑦ **FUNCTION OUT Connector**

The main output of the generator. The output of the function selected.

⑧ **SYNC OUT Connector**

Furnishes a TTL pulse for each cycle or period of the generator. To be used for scope or similar synchronization.

⑨ **FUNCTION Switch**

Selects one of six output signals: dc, waveforms or pulses.

⑩ **DC OFFSET Control**

Offsets the waveform or dc level at ⑦ from −15V to +15V (open circuit; ±7.5V into 50Ω). An OFF position ensures no offset.

⑪ **SYMMETRY Control**

Normal symmetrical output results when SYMMETRY is set to OFF; an asymmetrical, or unbalanced, waveform results when SYMMETRY is set between ⎍⎍ and ⎍⎍. (Asymmetrical operation reduces generator frequency to approximately 1/10th the normal output.) Figure 3-2 shows the effect of SYMMETRY control on the waveforms.

NOTE

When SYMMETRY control is used, the output frequency is different from the dial indicated frequency. The maximum symmetry ratio obtainable also depends on the frequency dial setting.

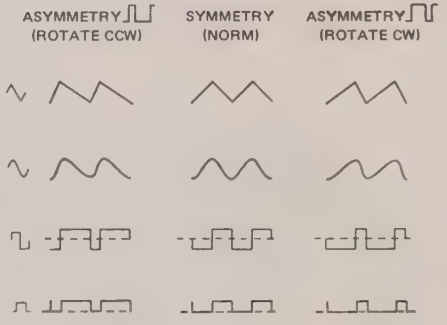


Figure 3-2. Effect of SYMMETRY Control

⑫ **TRIG IN Connector**

Accepts a 1V p-p to ±10V external signal to trigger the generator. (Up to ±50V will not damage circuitry.) Triggers on rising edge of input which crosses TRIGGER LEVEL ③ setting from negative to positive.

⑬ **VCG IN Connector**

Accepts 0 to +2V ac or dc voltages to vary up to 1000:1 the frequency and period of the outputs.

The upper and lower limits are defined by the maximum and minimum dial (2) settings multiplied by (14) . VCG input will not drive the generator beyond the normal dial limits of a range.

(14) **FREQUENCY MULT Switch**

The outer knob selects one of ten frequency multipliers for the dial (2) setting.

VERNIER Control

A fine adjustment of the frequency dial (2) setting.

Not Shown **GCV OUT Connector (Rear Panel)**

This connector gives a 0 to +2V signal proportional to the frequency of the generator within any given range. The signal can be used as the X drive for X-Y recorders.

Not Shown **EXT DC OFFSET IN Connector (Rear Panel)**

Applied voltage offsets the selected waveform linearly. Offset is 1V for each −1V applied with output connected into an open circuit. Maximum input is ±15V. Offset is affected by the attenuator (6) .

3.2 OPERATION

Perform the initial checkout in Section 2 for the feel of the instrument. Any questions concerning individual controls and connectors may be answered in paragraph 3.1.

3.2.1 Signal Termination

Proper signal termination, or loading, of the generator connectors is necessary for its specified operation. For example, the proper termination of the main output is shown in figure 3-3. Placing the 50Ω terminator, or 50Ω resistance, in parallel with a higher impedance matches the receiving instrument input impedance to the generator output impedance, thereby minimizing signal reflection or power loss on the line due to impedance mismatch.

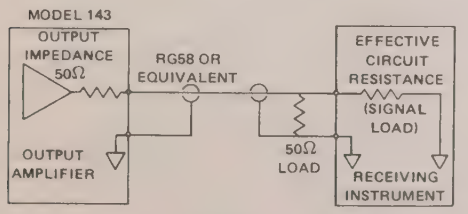


Figure 3-3. Signal Termination

3.2.2 Voltage Controlled Function Generator Operation

Operation as a voltage controlled function generator (VCG) is as for a manually controlled function generator, only the frequency within particular ranges is additionally controlled with dc levels (±2V excursions) injected at the VCG IN connector. Set the frequency dial to a reference from which the frequency is to be voltage controlled.

1. For frequency control with positive dc inputs at VCG IN, set the dial for a lower frequency limit.
2. For frequency control with negative dc inputs at VCG IN, set the dial for an upper frequency limit.
3. For modulation with an ac input at VCG IN, set the dial at the desired center frequency. Do not exceed the maximum dial range of the selected frequency range.

Figure 3-4 is a nomograph with examples of dial and voltage effects. Example 1 shows that with 0V VCG input, frequency is as determined by the main dial setting, 1.0 in this

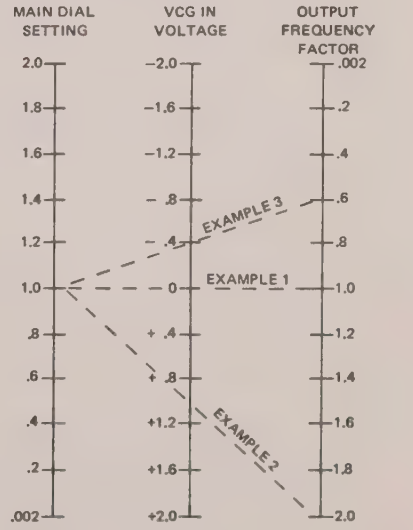


Figure 3-4. VCG Voltage-to-Frequency Nomograph

example. Example 2 shows that with a positive VCG input, output frequency is increased. Example 3 shows that with a negative VCG input, output frequency is decreased. (Note that the Output Frequency Factor column value must be multiplied by a frequency range multiplier to give the actual output frequency.)

NOTE

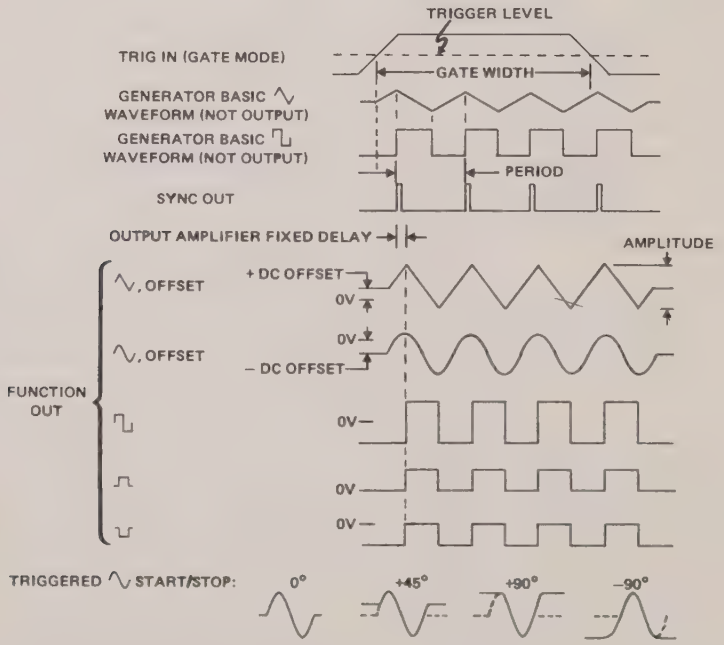
The frequency vernier must be rotated fully ccw for 1000:1 range.

Nonlinear operation results when the VCG input voltage is excessive; that is, when the attempted generator frequency exceeds the range setting (2 times the multiplier setting) or in the other direction, 1/1000th of the range setting.

The up to 1000:1 VCG sweep of the generator frequencies available in each range results from a 2V excursion at the VCG IN connector. With the frequency dial set to 2.0, excursions between −2V and 0V at VCG IN provide the up to 1000:1 frequency sweep. With the dial set to .002, excursions between 0V and +2V at VCG IN provide the up to 1000:1 sweep within the set frequency range.

3.2.3 Waveforms

See figure 3-5 for definition of controllable waveform characteristics.



NOTES

1. *Period is controlled by the generator frequency setting.*
2. *In trigger mode, just one period is generated for each trigger pulse.*
3. *DC offset plus peak waveform voltage > | 7.5V | causes waveform clipping.*

Figure 3-5. Waveform Characteristics

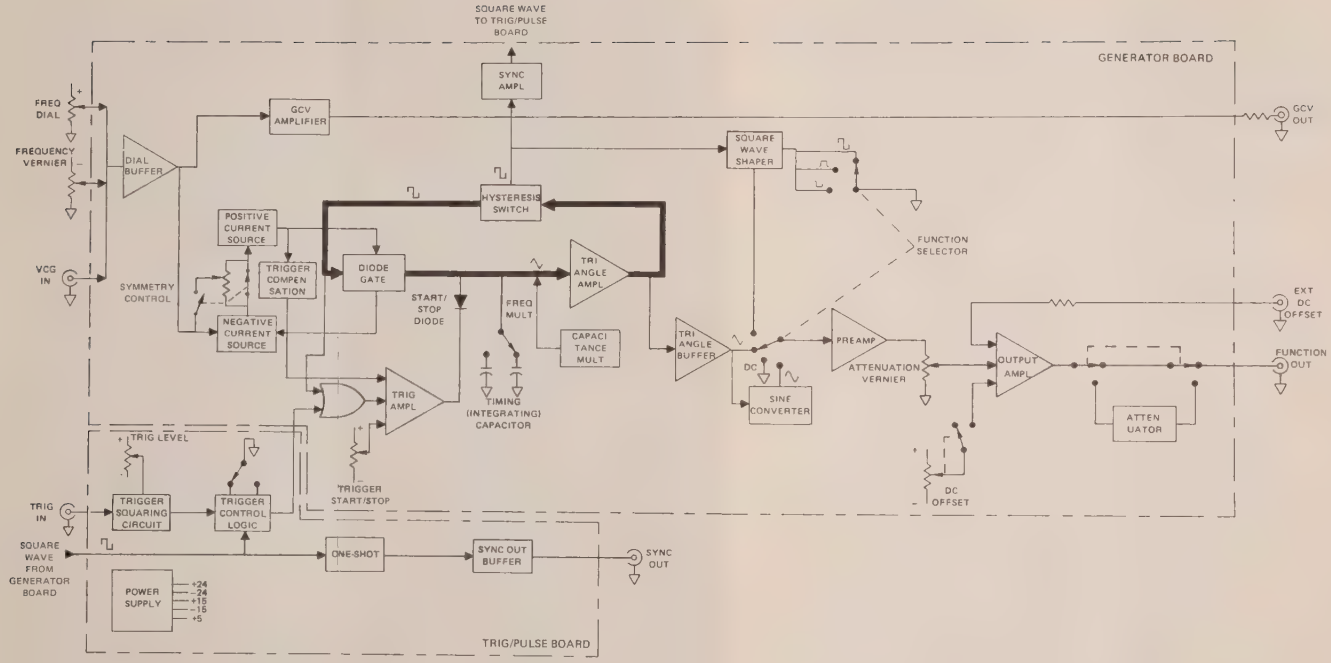


Figure 4-1. Overall Block Diagram

SECTION 4
CIRCUIT DESCRIPTION

4.1 BASIC WAVEFORM DEVELOPMENT

The heart of the generator (the bold path in figure 4-1) is a triangle and square wave generator. The triangle waves are developed by capacitor charging ramps that are alternately reversed in polarity. The polarity reversal is caused by a flip-flop circuit, or hysteresis switch, that in turn produces the square waves. The flip-flop changes states upon detecting amplitude limits of the charging ramps through the triangle amplifier.

As shown in figure 4-1, the VCG dial buffer sums the currents from the frequency dial, frequency vernier and VCG in connector. The VCG dial buffer is an inverting amplifier whose output voltage is used to control a positive current source and a negative current source. For symmetrical output waveforms, the currents from the two current sources are equal and directly proportional to the voltage of the VCG dial buffer output. The diode gate, which is controlled by the hysteresis switch, is used to switch the positive or the negative current to the integrating capacitor selected by the frequency multiplier. If the positive current is switched into the integrating capacitor, the voltage across the capacitor will rise linearly to generate the triangle rise transition. If the current is negative, the voltage across the integrating capacitor will fall linearly to produce the fall transition.

The triangle amplifier is a unity gain amplifier whose output is fed to the hysteresis switch. The hysteresis switch has two voltage limit points (+1.25 aand −1.25V) at its input.

During the time the output voltage of the triangle amplifier is rising, the output voltage of the hysteresis switch is positive, but when the output voltage of the triangle reaches +1.25V, it triggers the hysteresis switch causing the output to switch negative. Once the control voltage into the diode gate becomes negative, it will switch the positive current out and switch the negative current in to the integrating capacitor, so that the voltage across the capacitor will reverse, starting a linear decrease of the waveform. When the decreasing voltage reaches −1.25V, the output of the hysteresis switch will switch back to positive, reversing the process. This action generates the triangle waveform as shown in figure 4-2. Since the output of the hysteresis switch is a square wave, the result is simultaneous generation of a square wave and a triangle wave at the same frequency.

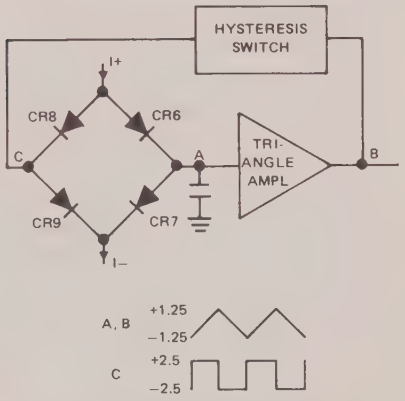


Figure 4-2. Basic Generator and Timing Diagram

The output frequency is determined by the magnitude of the capacitor selected by the frequency multiplier and the magnitude of the positive and negative current sources. Since the current sources are linearly proportional to the control voltage of the VCG circuit, the output frequency will also be linearly proportional to the control voltage.

When the symmetry control is turned on, the current of the negative current source is decreased by 19 times, and the fall time of the triangle is 19 times longer than the rise time of the triangle, resulting in an unsymmetrical waveform and a division of the frequency by a factor of 10. Gradually increasing the current from the negative current source and decreasing the current from the positive current source causes the time for the triangle to complete one cycle to remain constant, while the symmetry of the output waveform is continuously varied.

The output of the hysteresis switch is fed to the sync amplifier and also the square wave shaper. The square wave shaper consists of a shaping circuit which limits the square wave output swing to ±1.25V. For positive pulse outputs, it limits the output voltage swing from −1.25 to 0V; and for negative pulse outputs, it limits the output swing from 0 to +1.25V.

The triangle wave from the triangle amplifier is coupled through a buffer amplifier and made available to the function selector switch. The buffer amplifier provides a low impedance to drive the sine converter circuit. The sine converter, using the nonlinear characteristics of its diodes, converts the triangle wave into a sine wave.

The square wave from the sync amplifier, processed through a one-shot and the sync out buffer, is externally available at the sync out connector. The sync pulse, then, is a TTL level pulse output of the generator frequency.

4.2 AMPLITUDE OFFSET AND ATTENUATION

The selected waveform is inverted and amplified in the preamplifier. The preamplified waveform is sent to the output amplifier.

The output amplifier is an inverting amplifier with a current limiting output stage for short circuit protection. The dc offset control provides the offset to the selected waveforms center reference. The dc offset can be set by voltage at the external dc offset connector. The output amplifier establishes the generator 0 dB attenuation reference. An output attenuator decreases this reference amplitude in operator selected 20 dB steps. The attenuator consists of three voltage dividers. Attenuation between the steps is provided by the attenuation vernier.

4.3 TRIGGER AND GATE CONTROL

Generator operation is controlled by allowing or preventing the timing capacitor to charge. For figure 4-3 shows in detail this portion of the circuit. For continuous operation, the trigger amplifier maintains a positive level above the positive peak developed by the charging capacitors. This reverse biases (turns off) the start/stop diode, and the trigger amplifier does not interfere with continuous operation.

When the trigger amplifier outputs some level below the positive peak charging level, the diode is forward biased (turned on) to sink the integrating current from the current source, preventing the capacitors from charging to the positive peak. This stops waveform generation and holds the triangle output at some dc level called the trigger baseline. The trigger baseline is the level where a triangle waveform cycle starts and where it stops. This baseline is directly applicable to the triangle waveform and thus affects the sine wave. The square wave levels, output via the hysteresis switch, are not affected by the triangle baseline levels.

The normal trigger baseline is zero volts, analogous to 0° phase of a sine or triangle waveform. The trigger start/stop control offsets the trigger amplifier output and can change the baseline for starting and stopping a sine or triangle waveform from its negative peak (−90°) to its positive peak (+90°) range. At the extreme positive peak level setting, though, the diode is again reverse biased and generator operation goes continuous.

When charging level is being held, the positive current generator still varies its output with corresponding frequency control inputs. These varying currents must be sunk through the diode to keep the timing capacitors from varying their charge, and thus varying the trigger baseline. The baseline compensation circuit monitors the output from the positive current generator to control the trigger amplifier and thus control the necessary compensating current through the diode.

The trigger control logic determines that after a waveform starts, it always stops at a complete cycle and at the same phase at which it started. The trigger control logic latches the trigger amplifier for an enabling output from the time the cycle starts to when the negative peak of the last cycle is reached (just one cycle in the trigger mode). Upon reaching the negative peak, the timing capacitor continues charging positive again, but stops upon reaching the trigger baseline. A square wave from the hysteresis switch synchronizes the last negative peak time for unlatching the trigger amplifier for its trigger baseline output.

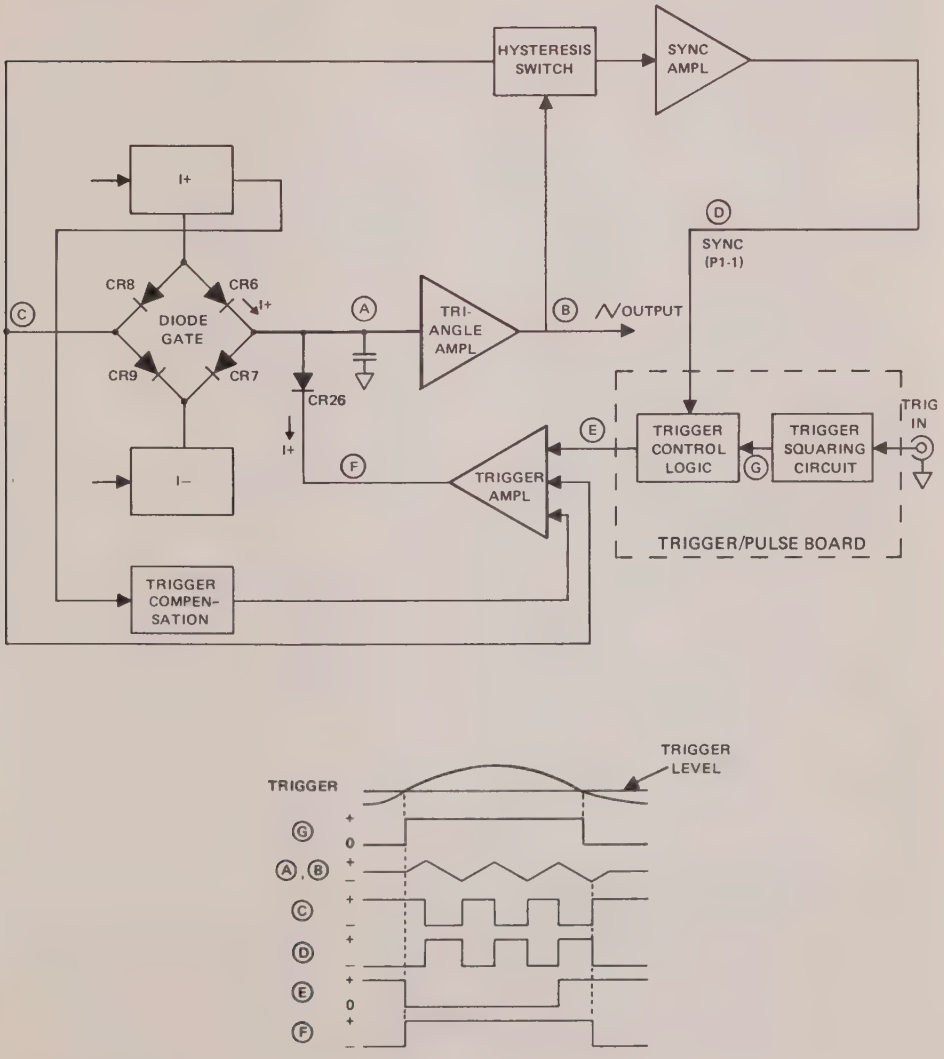


Figure 4-3. Trigger Circuit and Timing

SECTION 5
CALIBRATION

5.1 FACTORY REPAIR

Wavetek maintains a factory repair department for those customers not possessing the necessary personnel or test equipment to maintain the instrument. If an instrument is returned to the factory for calibration or repair, a detailed description of the specific problem should be attached to minimize turnaround time.

5.2 REQUIRED TEST EQUIPMENT

Voltmeter . . . . . 0.1 mVdc resolution (0.1% accuracy)
Oscilloscope, Dual Channel . . . . . ⩾ 150 MHz bandwidth
Distortion Analyzer . . . . . To 600 kHz
Counter . . . . . To 20 MHz (0.1% accuracy)
50Ω Load . . . . . ±0.1% accuracy, 2W
Generator . . . . . 200 kHz signal, 2 to 20V p-p

5.3 REMOVING GENERATOR COVERS

1. Invert the instrument, remove the four screws in the cover.

2. Turn the instrument upright, remove the top cover, and remove the four screws securing the bottom cover.

3. Replace the top cover and turn the instrument upside down.

NOTE

Remove the bottom cover only when it is necessary to make adjustments or measurements.

5.4 CALIBRATION

After referring to the following preliminary data, perform calibration, as necessary, per table 5-1. If performing partial calibration, check previous settings and adjustments for applicability. See figures 5-1 and 5-2 for calibration point location.

1. Unless otherwise noted, all measurements made at the 50Ω OUT connector should be terminated into a 50Ω (±0.1%) load.

2. Verify operation in TRIG and GATE modes by connecting an external generator to the TRIG IN BNC and observing proper operation of TRIGGER LEVEL and TRIGGER START/STOP controls (paragraph 3.1).

3. Verify SYNC OUT is an approximate 30 ns positive pulse into 50Ω and that GCV OUT is a voltage proportional to dial position with a 2V max (open circuit).

4. Start the calibration by connecting the unit to an ac source and setting the front panel switches as follows:

Dial 02
FREQ MULT 100K
FREQ VERNIER . . . . . Full cw
GENERATOR MODE . . . . . CONT
TRIGGER LEVEL . . . . . Full ccw
TRIGGER START/STOP . . . . . 0° CAL
SYMMETRY . . . . . OFF
DC OFFSET . . . . . OFF
FUNCTION . . . . . DC
ATTENUATION . . . . . 20 ▮ 0
ATTENUATION VERNIER . . . . . Full ccw
POWER . . . . . ON

5. Allow the unit to warm up at least 30 minutes for final calibration. Keep the instrument covers on to maintain heat. Remove covers only to make adjustments or measurements.

Table 5-1. Calibration Chart

Step	Check	Tester	Cal Points	Control Settings	Adjust	Desired Results	Remarks
1	Power Supply	DVM	C111			+15 ±0.05 Vdc	If voltage is incorrect, proceed to step 3.
2			C112			−15 ±0.05 Vdc	If voltage is correct, proceed to step 9.

Steps 3 - 7 are on the trig/pulse board. Place the cover on the generator and turn it upright. Remove the top cover for access to the trig/pulse board.

3	Power Supply	DVM	TP1 (COM) TP2 (±15 Vdc)		R27	+15 ±0.02 Vdc	
4			TP3			−15 ±0.05 Vdc	
5			TP4			+24 ±1 Vdc	
6			TP5			−24 ±1 Vdc	
7			TP6			+5 ±0.2 Vdc	

If steps 3 - 7 were performed, place the cover on, invert the generator and warm up the generator for ½ hour. Remove the uppermost cover for generator board access when required.

8	Cap Mult Balance	DVM (DCV)	TP5 (COM) TP1		R55	< 5 mV	
9	Power Ampl Balance		FUNC-TION OUT		R181	0 ±0.01 Vdc	Terminate with 50Ω load.
10	Preamp Balance			ATTENUATION VERNIER: full cw	R252	0 ±0.01 Vdc	
11	VCG Null	Scope		FUNCTION: ⊓⊔	R12	Minimum frequency shift	Observe one cycle at 50μs/div. Alternately short and open VCG IN BNC while adjusting R12.
12	1000:1 Freq			FREQ VERNIER: full ccw	R13 BOD Freq Adj	< 1 cycle (< 200 Hz)	Scope on .5 ms/div.

Table 5-1. Calibration Chart (Continued)

Step	Check	Tester	Cal Points	Control Settings	Adjust	Desired Results	Remarks
13	1000:1 Symmetry	Scope	FUNCTION OUT		R16 BOD Sym	Symmetrical waveform	*NOTE: Steps 13 and 14 are interactive.*
14	Main Symmetry			FREQ VERNIER: full cw Dial: 2.0 FREQ MULT: 1K	R35 TOD Sym	Symmetrical waveform	
15	Sine Distortion	Distortion Analyzer, Scope		FUNCTION: ∿	R120 Triangle Balance	Symmetrical residue	Connect FUNCTION OUT to distortion analyzer and distortion analyzer output to scope. Set scope to .1V/div. Sync scope to SYNC OUT BNC loaded into 50Ω.
16					R93, R107 Triangle Peaks	Minimum sine distortion	If either adjustment is going near a stop, recenter both pots and return to step 15.
17	Main Freq	Frequency Counter/ Timer		FUNCTION: ⊓	R4 TOD Freq Adj	2000 ±10 Hz	Remove SYNC OUT cable.
18	Cap Mult Freq			FREQ MULT: 10	R48	20 ±0.1 Hz	
19	X 10M Freq			FREQ MULT: 10M Dial: Vary	C40	Best frequency tracking over X 10M range	
20	X 1M Freq			FREQ MULT: 1M Dial: Vary	C34	Best frequency tracking over X 1M range	This adjustment must be made each time step 20 is done.
21	Trigger Baseline	Scope		FUNCTION: ∿ GENERATOR MODE: TRIG Dial: Vary	R162	Minimum shift of baseline around 0 Vdc	

Figure 5-1. Generator Board

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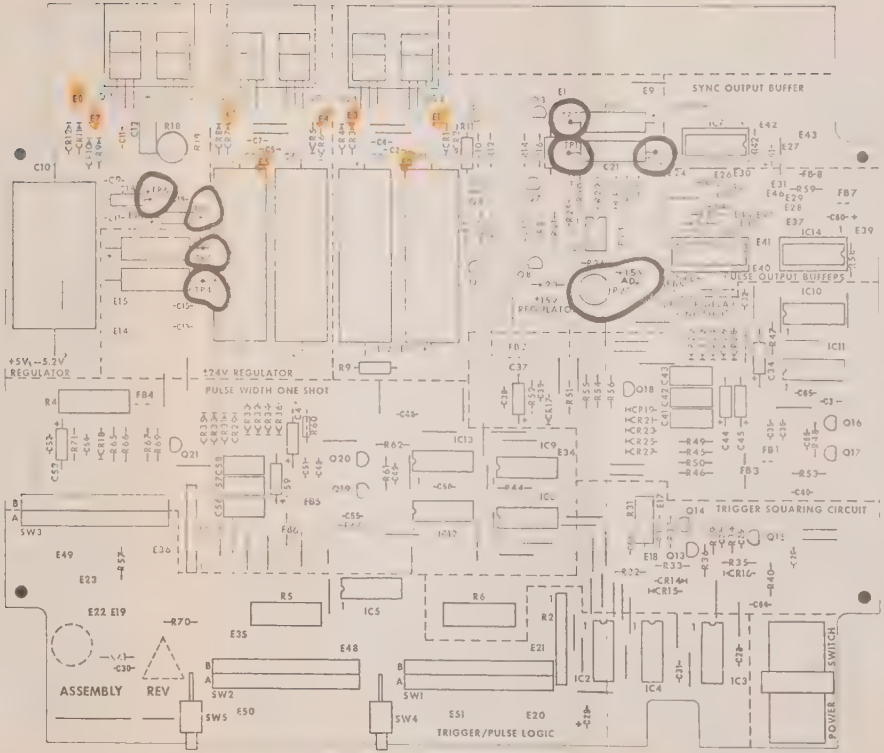


Figure 5-2. Trig/Pulse Board

SECTION 6
TROUBLESHOOTING

6.1 FACTORY REPAIR

Wavetek maintains a factory repair department for those customers not possessing the necessary personnel or test equipment to maintain the instrument. If an instrument is returned to the factory for calibration or repair, a detailed description of the specific problem should be attached to minimize turnaround time.

6.2 TROUBLESHOOTING CHARTS

Troubleshooting charts are given in figures 6-1 thru 6-9. The charts do not cover every possible trouble, but will be an aid in systematically isolating faulty components.

Figure 6-1. Initial Checks, Generator Board
Figure 6-2. Generator Loop Checks, Generator Board
Figure 6-3. VCG Checks, Generator Board
Figure 6-4. Generator Output Checks
Figure 6-5. Trigger and Gate Mode Checks, Trig/Pulse Board
Figure 6-6. Power Supply Checks, Trig/Pulse Board
Figure 6-7. Generator Input and Output Checks

6.3 TROUBLESHOOTING INDIVIDUAL COMPONENTS

6.3.1 Transistor

1. A transistor is defective if more than one volt is measured across its base emitter junction in the forward direction.

2. A transistor when used as a switch may have a few volts reverse bias voltage across base-emitter junction.

3. If the collector and emitter voltages are the same, but the base emitter voltage is less than 500 mV forward voltage (or reversed bias), the transistor is defective.

4. A transistor is defective if its base current is larger than 10% of its emitter current (calculate currents from voltage across the base and emitter series resistors).

5. In a transistor differential pair (common emitter stages), either their base voltages are the same in normal operating condition, or the one with less forward voltage across its base emitter junction should be off (no collector current); otherwise, one of the transistors is defective.

6.3.2 Diode

1. A diode is defective if there is greater than one volt (typically 0.7 volt) forward voltage across it.

6.3.3 Operational Amplifier (e.g., 741, 1458)

1. The "+" and "—" inputs of an operational amplifier will have less than 15 mV voltage difference when operating under normal conditions.

2. When the output of the amplifier is connected to the "—" input (voltage follower connection), the output should be the same voltage as the "+" input voltage; otherwise, the operational amplifier is defective.

6.3.4 Capacitor

1. Shorted capacitors have zero volts across their terminals.

2. Opened capacitor can be located (but not always) by using a good capacitor connected in parallel with the capacitor under test and observing the resulting effect.

6.3.5 Digital TTL IC's (e.g. 7400 Series)

1. The device is operating correctly if the output high state is $> +2.4V$ and low state is $< +0.5V$.

2. The input must show the same two levels as in step 1. If the levels are between +0.8V and +2.0V, the connection to the driving circuit output is open.

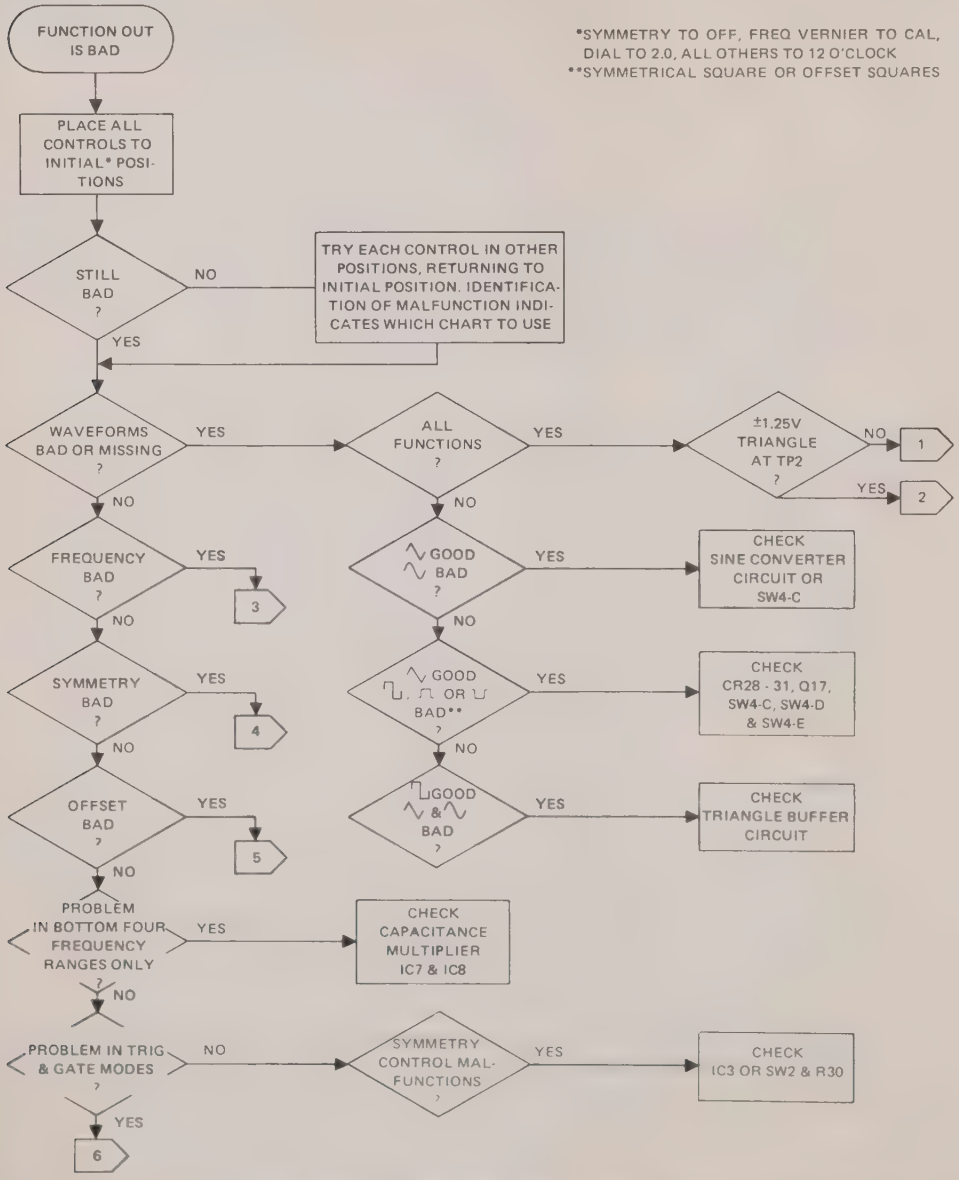
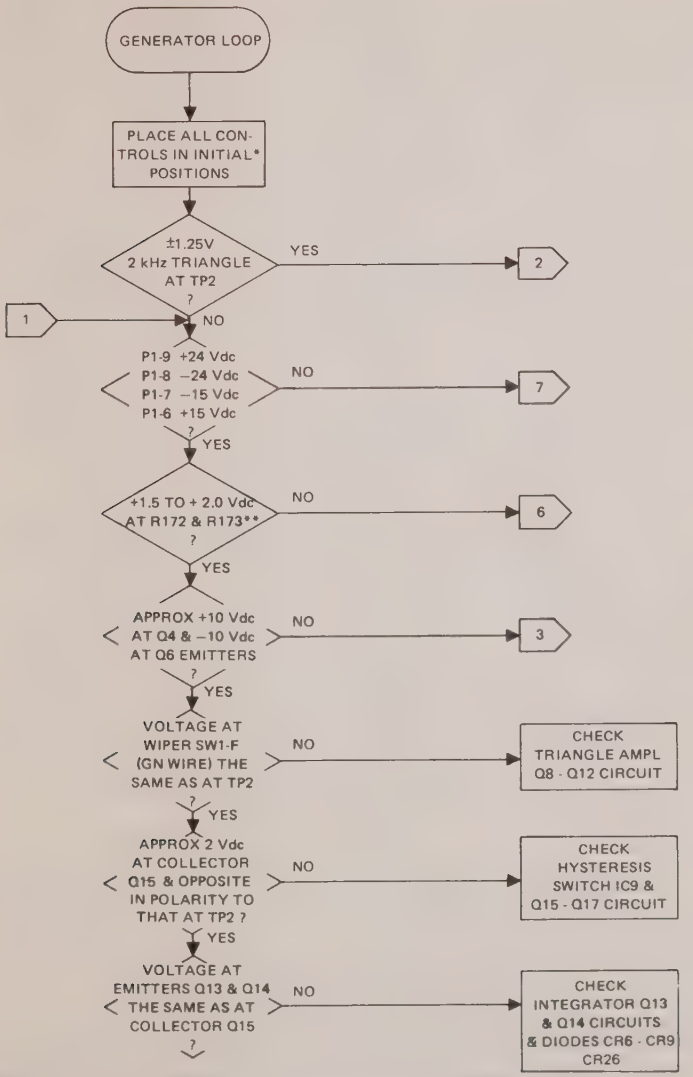


Figure 6-1. Initial Checks, Generator Board

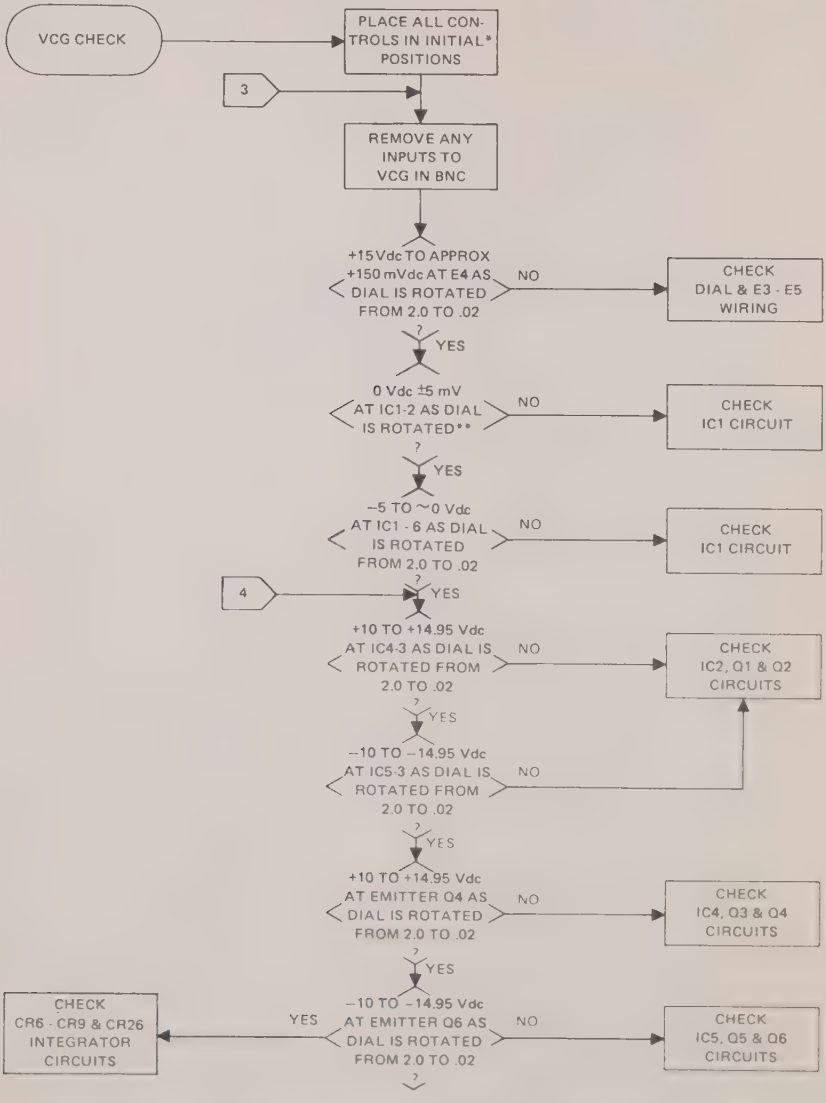


*SYMMETRY TO OFF, FREQ VERNIER TO CAL, DIAL TO 2.0, ALL OTHERS TO 12 O'CLOCK

**A NEGATIVE VOLTAGE HERE STOPS GENERATOR FOR TRIGGERED OPERATION

***USE SCOPE AND HIGH IMPEDANCE PROBE

Figure 6-2. Generator Loop Checks, Generator Board


VCG CHECK
PLACE ALL CONTROLS IN INITIAL* POSITIONS
3
REMOVE ANY INPUTS TO VCG IN BNC
+15 Vdc TO APPROX +150 mVdc AT E4 AS DIAL IS ROTATED FROM 2.0 TO .02
NO
CHECK DIAL & E3 - E5 WIRING
YES
0 Vdc ±5 mV AT IC1-2 AS DIAL IS ROTATED**
NO
CHECK IC1 CIRCUIT
YES
−5 TO ~0 Vdc AT IC1 - 6 AS DIAL IS ROTATED FROM 2.0 TO .02
NO
CHECK IC1 CIRCUIT
4
YES
+10 TO +14.95 Vdc AT IC4-3 AS DIAL IS ROTATED FROM 2.0 TO .02
NO
CHECK IC2, Q1 & Q2 CIRCUITS
YES
−10 TO −14.95 Vdc AT IC5-3 AS DIAL IS ROTATED FROM 2.0 TO .02
NO
YES
+10 TO +14.95 Vdc AT EMITTER Q4 AS DIAL IS ROTATED FROM 2.0 TO .02
NO
CHECK IC4, Q3 & Q4 CIRCUITS
YES
−10 TO −14.95 Vdc AT EMITTER Q6 AS DIAL IS ROTATED FROM 2.0 TO .02
NO
CHECK IC5, Q5 & Q6 CIRCUITS
YES
CHECK CR6 - CR9 & CR26 INTEGRATOR CIRCUITS

*SYMMETRY TO OFF, FREQ VERNIER TO CAL, DIAL TO 2.0, ALL OTHERS TO 12 O'CLOCK
**USE SCOPE AND HIGH IMPEDANCE PROBE FOR THIS AND SUBSEQUENT VCG MEASUREMENTS

Figure 6-3. VCG Checks, Generator Board

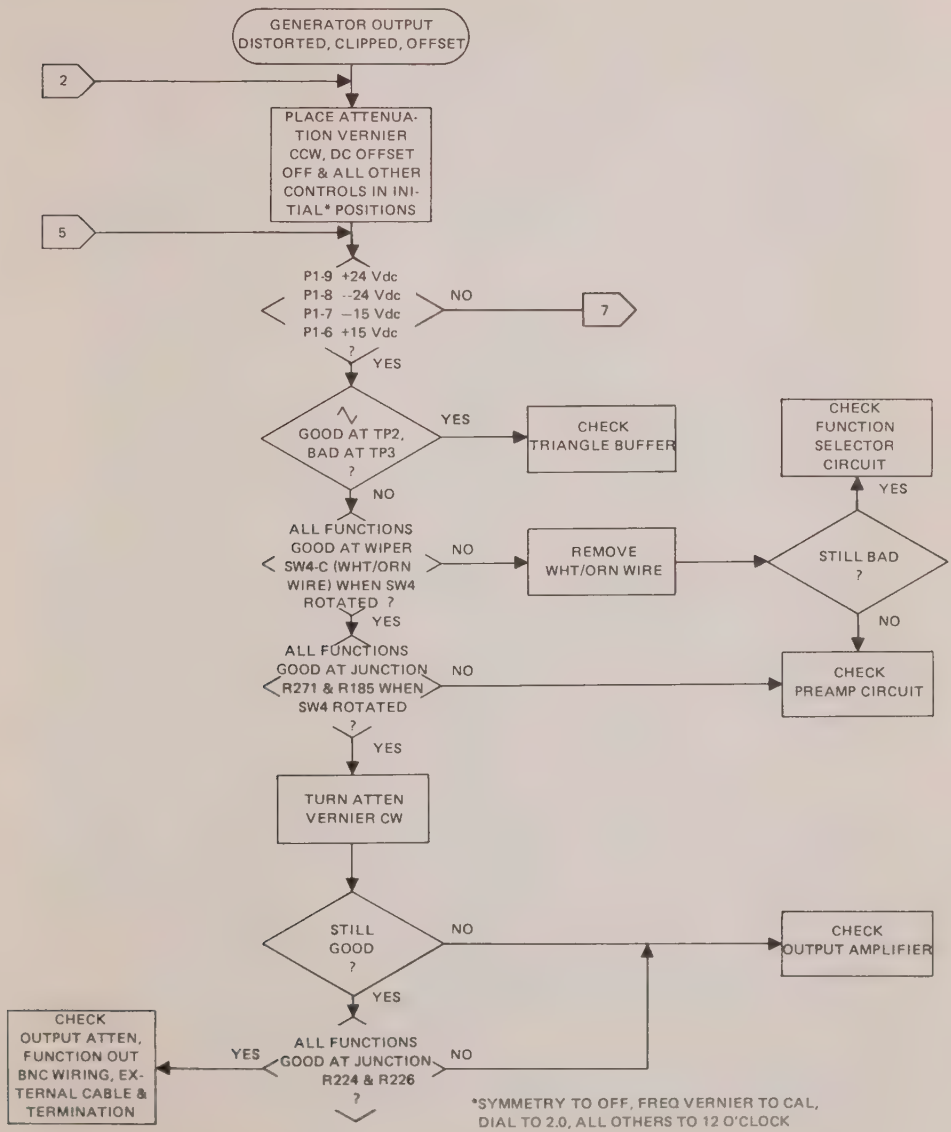
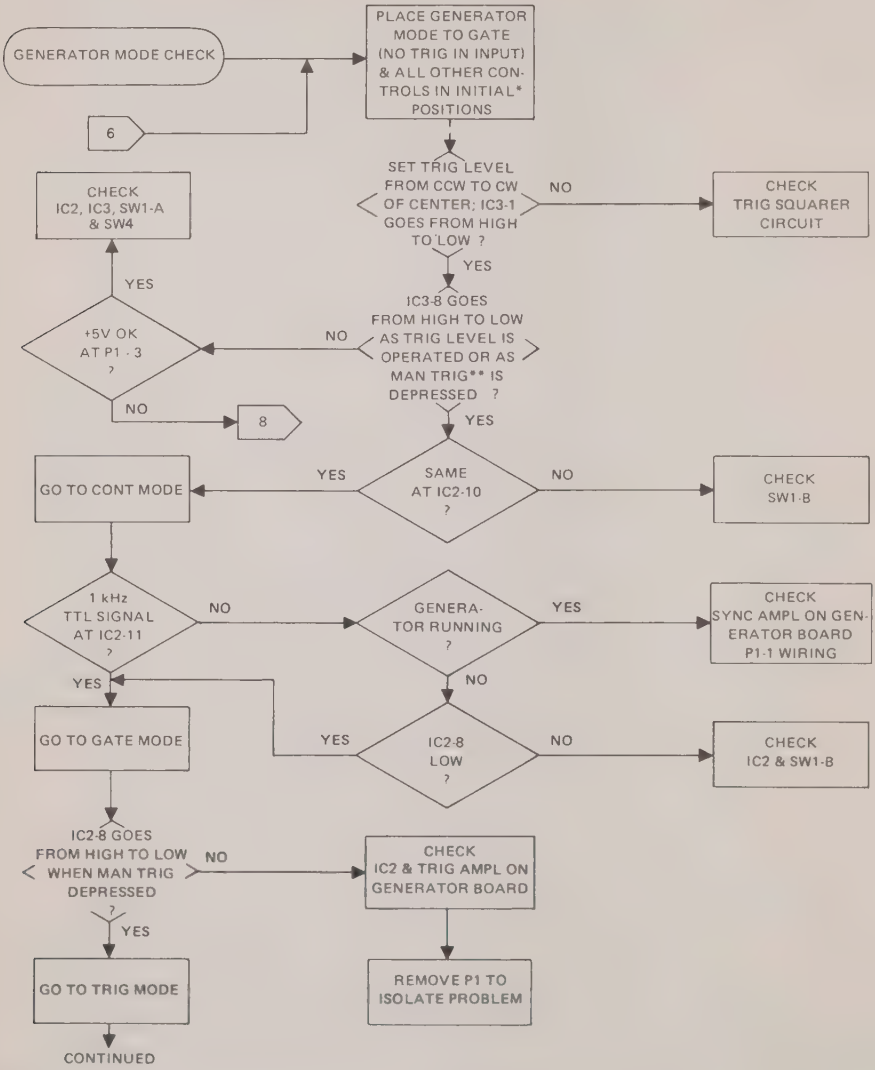


Figure 6-4. Generator Output Checks, Generator Board


GENERATOR MODE CHECK
PLACE GENERATOR MODE TO GATE (NO TRIG IN INPUT) & ALL OTHER CONTROLS IN INITIAL* POSITIONS
6
SET TRIG LEVEL FROM CCW TO CW OF CENTER; IC3-1 GOES FROM HIGH TO LOW ?
NO
CHECK TRIG SQUARER CIRCUIT
YES
CHECK IC2, IC3, SW1-A & SW4
YES
IC3-8 GOES FROM HIGH TO LOW AS TRIG LEVEL IS OPERATED OR AS MAN TRIG** IS DEPRESSED ?
+5V OK AT P1 - 3 ?
NO
NO
8
YES
GO TO CONT MODE
YES
SAME AT IC2-10 ?
NO
CHECK SW1-B
1 kHz TTL SIGNAL AT IC2-11 ?
NO
GENERATOR RUNNING ?
YES
CHECK SYNC AMPL ON GENERATOR BOARD P1-1 WIRING
YES
NO
GO TO GATE MODE
YES
IC2-8 LOW ?
NO
CHECK IC2 & SW1-B
IC2-8 GOES FROM HIGH TO LOW WHEN MAN TRIG DEPRESSED ?
NO
CHECK IC2 & TRIG AMPL ON GENERATOR BOARD
YES
GO TO TRIG MODE
REMOVE P1 TO ISOLATE PROBLEM
CONTINUED

*SYMMETRY TO OFF, FREQ VERNIER TO CAL, DIAL TO 2.0, ALL OTHERS TO 12 O'CLOCK
**RETURN TRIG LEVEL CCW TO OPERATE MANUAL TRIGGER

Figure 6-5. Trigger and Gate Mode Checks, Trig/Pulse Board (Page 1 of 2)

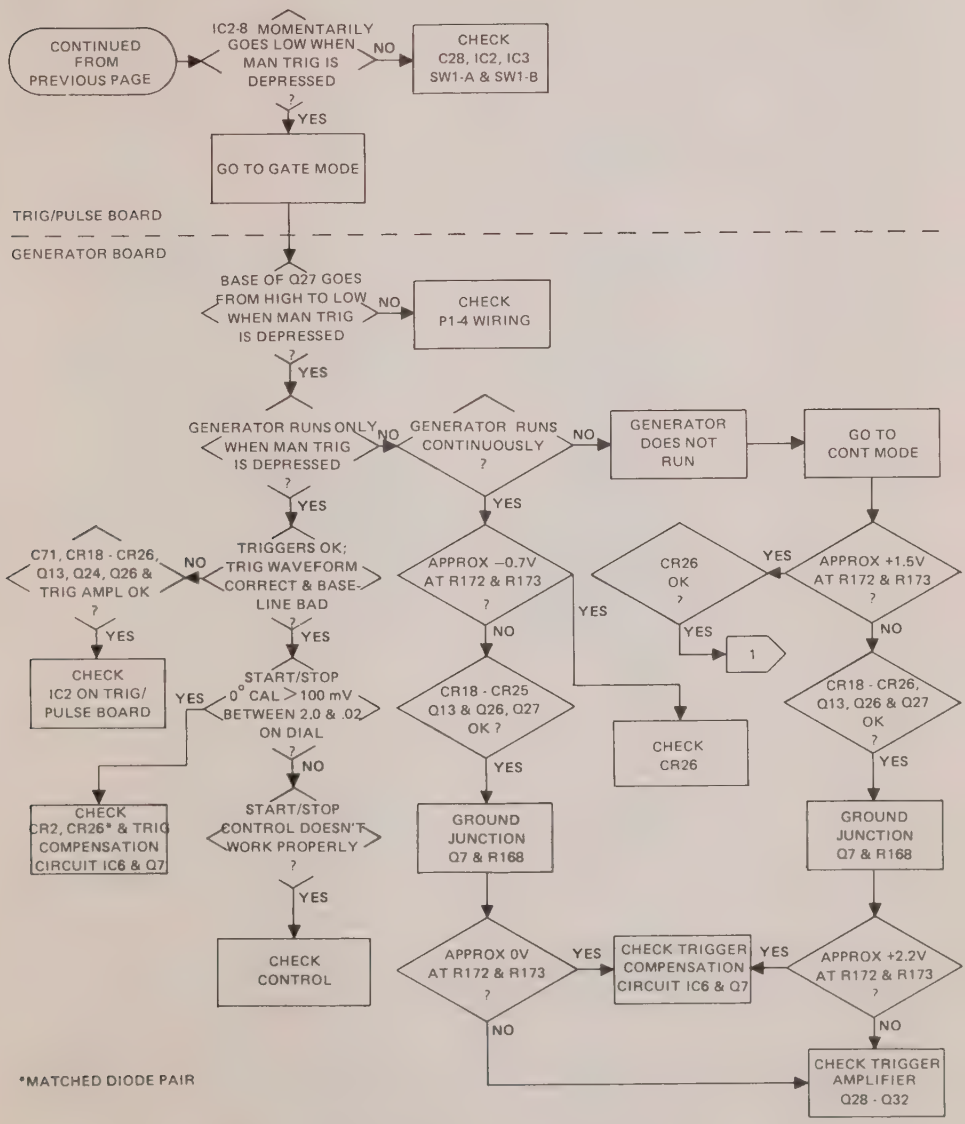


Figure 6-5. Trigger and Gate Mode Checks, Trig/Pulse Board (Page 2 of 2)

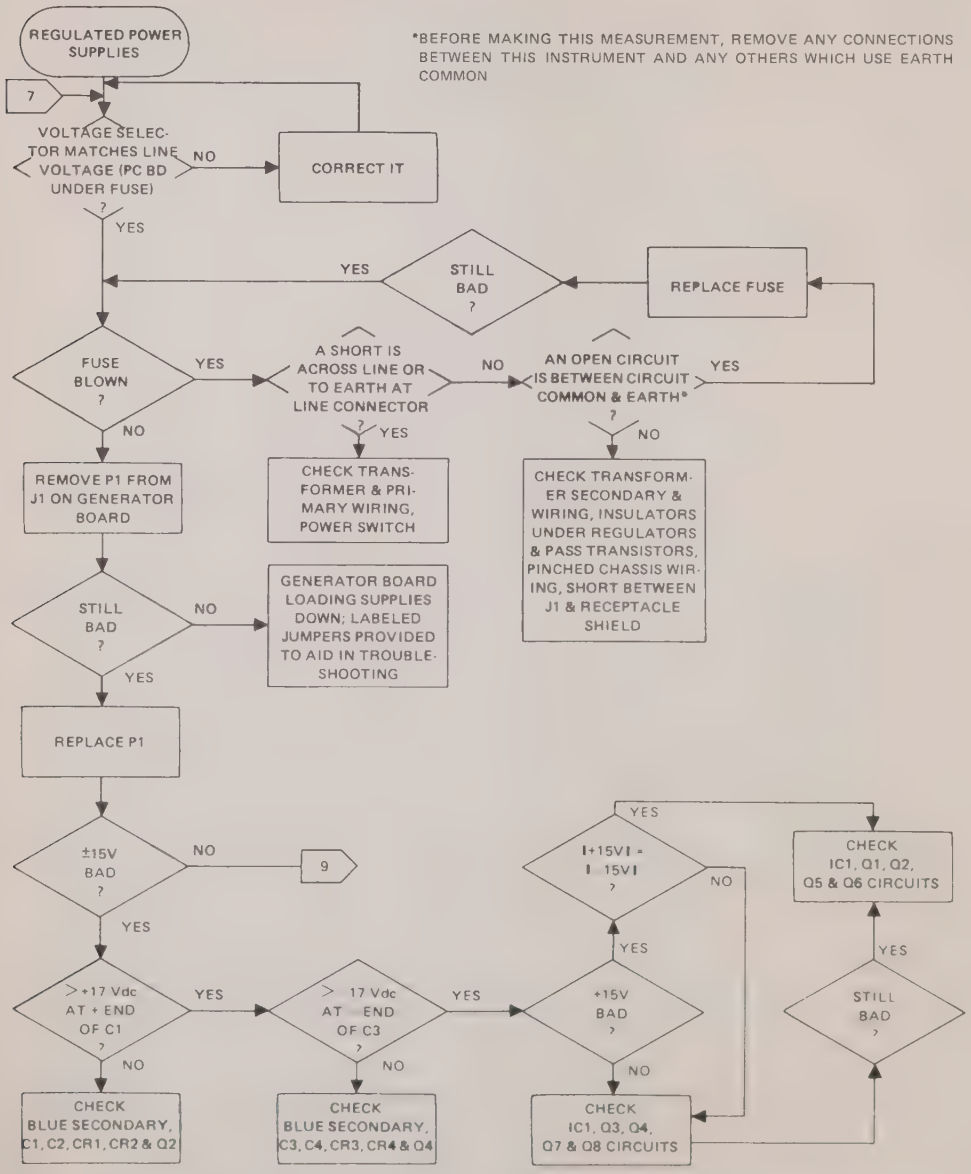

REGULATED POWER SUPPLIES
*BEFORE MAKING THIS MEASUREMENT, REMOVE ANY CONNECTIONS BETWEEN THIS INSTRUMENT AND ANY OTHERS WHICH USE EARTH COMMON
7
VOLTAGE SELECTOR MATCHES LINE VOLTAGE (PC BD UNDER FUSE) ?
NO
CORRECT IT
YES
STILL BAD ?
YES
REPLACE FUSE
FUSE BLOWN ?
YES
A SHORT IS ACROSS LINE OR TO EARTH AT LINE CONNECTOR ?
NO
AN OPEN CIRCUIT IS BETWEEN CIRCUIT COMMON & EARTH* ?
YES
NO
YES
NO
REMOVE P1 FROM J1 ON GENERATOR BOARD
CHECK TRANSFORMER & PRIMARY WIRING, POWER SWITCH
CHECK TRANSFORMER SECONDARY & WIRING, INSULATORS UNDER REGULATORS & PASS TRANSISTORS, PINCHED CHASSIS WIRING, SHORT BETWEEN J1 & RECEPTACLE SHIELD
STILL BAD ?
NO
GENERATOR BOARD LOADING SUPPLIES DOWN; LABELED JUMPERS PROVIDED TO AID IN TROUBLESHOOTING
YES
REPLACE P1
±15V BAD ?
NO
9
YES
|+15V| = |-15V| ?
YES
NO
CHECK IC1, Q1, Q2, Q5 & Q6 CIRCUITS
> +17 Vdc AT + END OF C1 ?
YES
> -17 Vdc AT - END OF C3 ?
YES
+15V BAD ?
YES
STILL BAD ?
YES
NO
NO
NO
CHECK BLUE SECONDARY, C1, C2, CR1, CR2 & Q2
CHECK BLUE SECONDARY, C3, C4, CR3, CR4 & Q4
CHECK IC1, Q3, Q4, Q7 & Q8 CIRCUITS

Figure 6-6. Power Supply Checks, Trig/Pulse Board (Page 1 of 2)

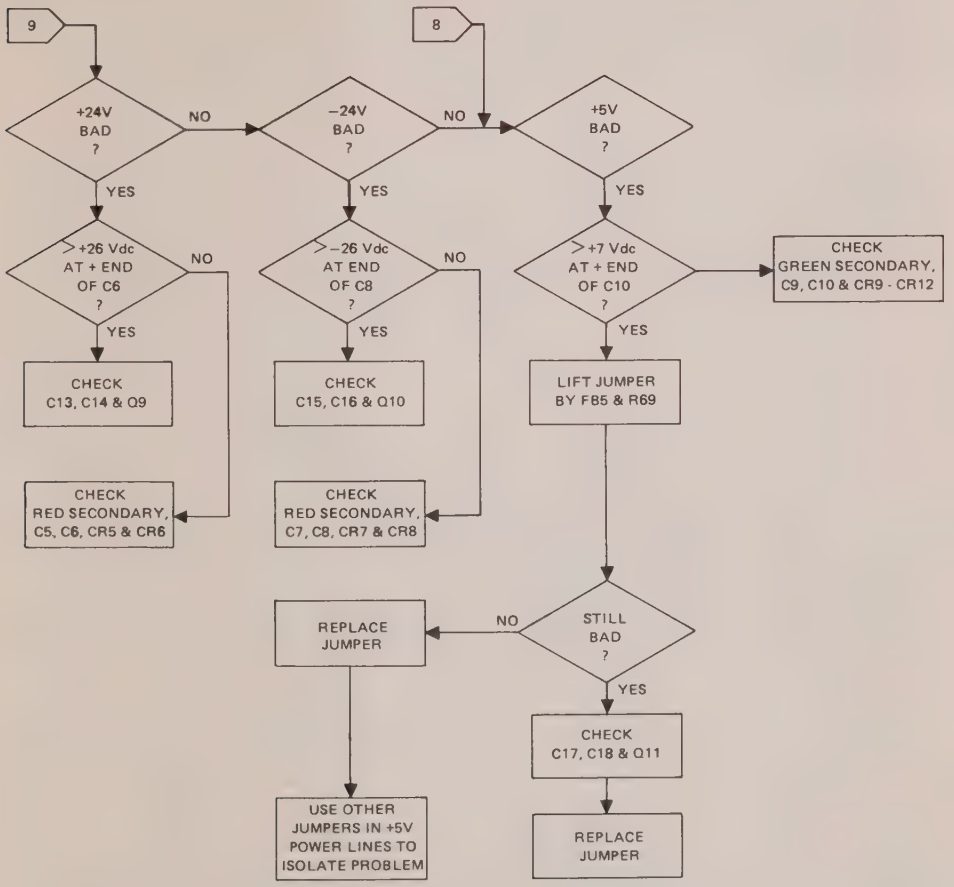


Figure 6-6. Power Supply Checks, Trig/Pulse Board (Page 2 of 2)

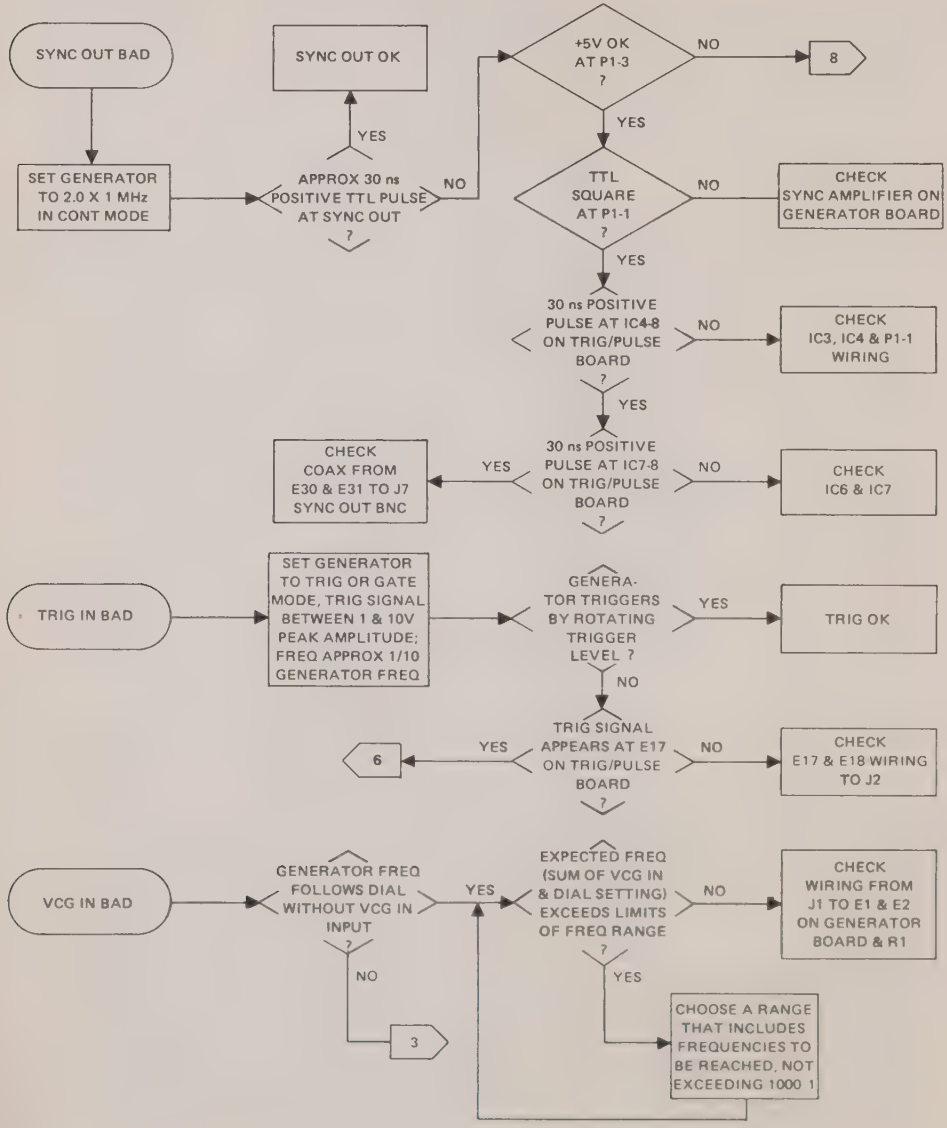

SYNC OUT BAD
SET GENERATOR TO 2.0 X 1 MHz IN CONT MODE
APPROX 30 ns POSITIVE TTL PULSE AT SYNC OUT ?
YES
SYNC OUT OK
NO
+5V OK AT P1-3 ?
NO
8
YES
TTL SQUARE AT P1-1 ?
NO
CHECK SYNC AMPLIFIER ON GENERATOR BOARD
YES
30 ns POSITIVE PULSE AT IC4-8 ON TRIG/PULSE BOARD ?
NO
CHECK IC3, IC4 & P1-1 WIRING
YES
30 ns POSITIVE PULSE AT IC7-8 ON TRIG/PULSE BOARD ?
NO
CHECK IC6 & IC7
YES
CHECK COAX FROM E30 & E31 TO J7 SYNC OUT BNC
TRIG IN BAD
SET GENERATOR TO TRIG OR GATE MODE, TRIG SIGNAL BETWEEN 1 & 10V PEAK AMPLITUDE; FREQ APPROX 1/10 GENERATOR FREQ
GENERATOR TRIGGERS BY ROTATING TRIGGER LEVEL ?
YES
TRIG OK
NO
TRIG SIGNAL APPEARS AT E17 ON TRIG/PULSE BOARD ?
NO
CHECK E17 & E18 WIRING TO J2
YES
6
VCG IN BAD
GENERATOR FREQ FOLLOWS DIAL WITHOUT VCG IN INPUT ?
YES
EXPECTED FREQ (SUM OF VCG IN & DIAL SETTING) EXCEEDS LIMITS OF FREQ RANGE ?
NO
CHECK WIRING FROM J1 TO E1 & E2 ON GENERATOR BOARD & R1
YES
CHOOSE A RANGE THAT INCLUDES FREQUENCIES TO BE REACHED, NOT EXCEEDING 1000 1
NO
3

Figure 6-7. Generator Input and Output Checks (Page 1 of 2)

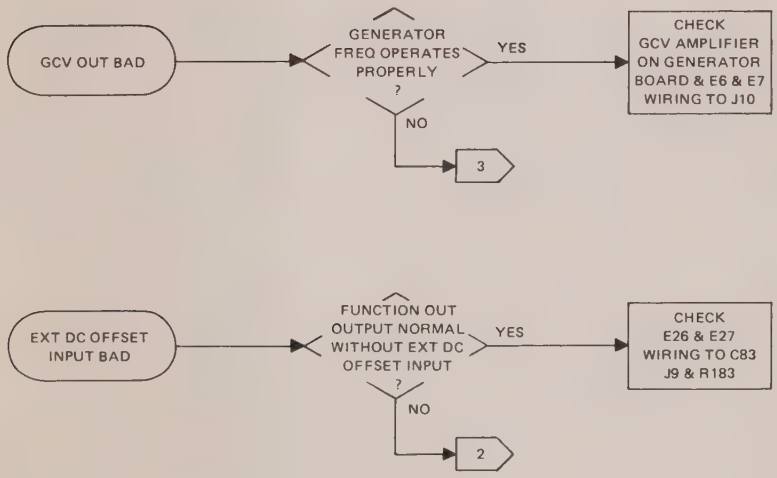

GCV OUT BAD
GENERATOR FREQ OPERATES PROPERLY ?
YES
CHECK GCV AMPLIFIER ON GENERATOR BOARD & E6 & E7 WIRING TO J10
NO
3
EXT DC OFFSET INPUT BAD
FUNCTION OUT OUTPUT NORMAL WITHOUT EXT DC OFFSET INPUT ?
YES
CHECK E26 & E27 WIRING TO C83 J9 & R183
NO
2

Figure 6-7. Generator Input and Output Checks (Page 2 of 2)

SECTION 7
PARTS AND SCHEMATICS

7.1 DRAWINGS

The following assembly drawings (with parts lists) and schematics are in the arrangement shown below.

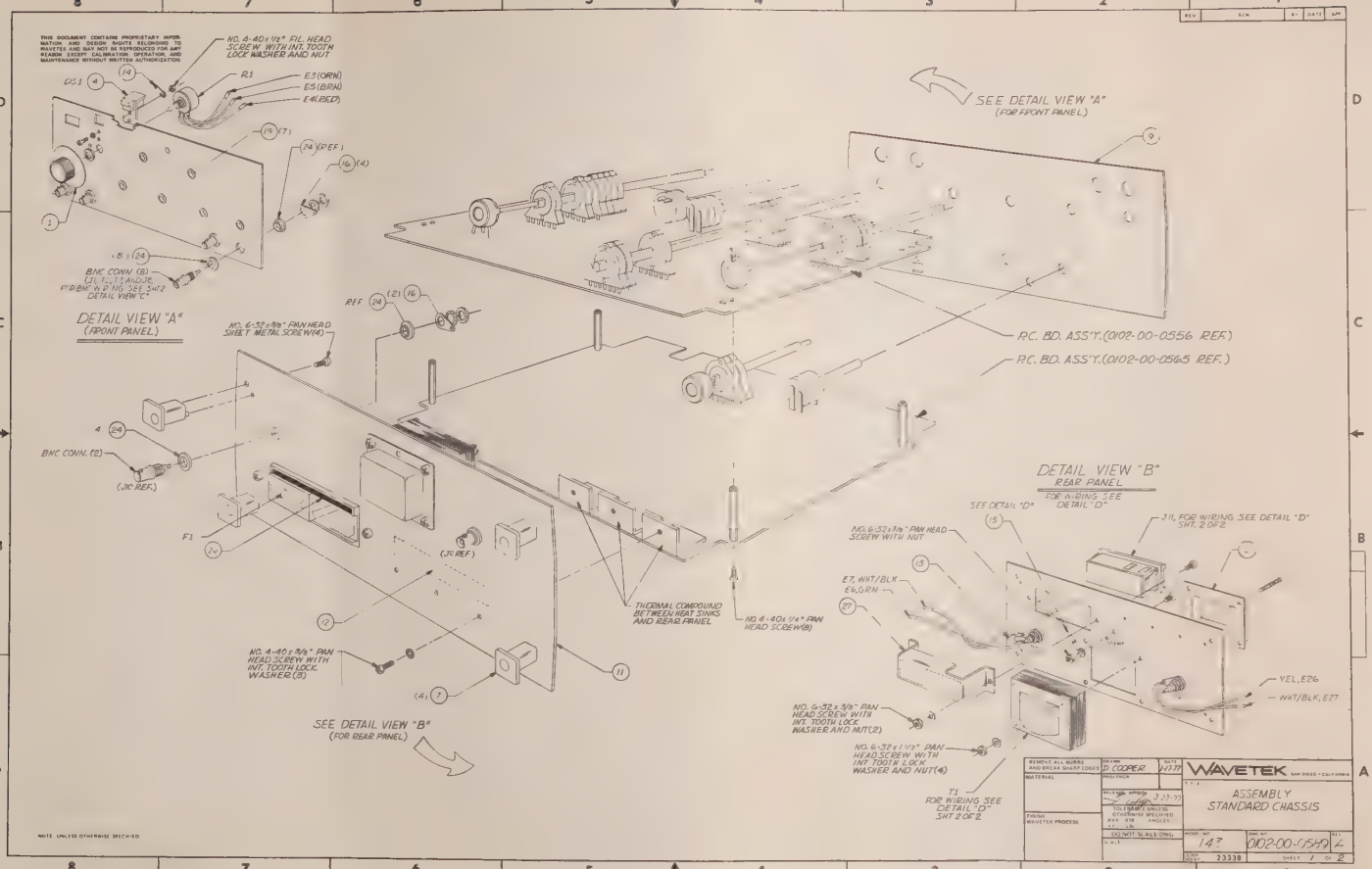
7.2 ORDERING PARTS

When ordering spare parts, please specify part number, circuit reference, board, serial number of unit and, if applicable, the function performed.

7.3 ADDENDA

Under Wavetek's product improvement program, the latest electronic designs and circuits are incorporated into each Wavetek instrument as quickly as development and testing permit. Because of the time needed to compose and print instruction manuals, it is not always possible to include the most recent changes in the initial printing. Whenever this occurs, addendum pages are prepared to summarize the changes made and are inserted immediately inside the rear cover. If no such pages exist, the manual is correct as printed.

Drawings	Drawing No.
CHASSIS	
Assembly Drawing	0102-00-0589
Schematic	0004-00-0101
Parts List	1101-00-0589
GENERATOR BOARD	
Parts Locater Drawing	0100-00-0556
Assembly Drawing (Sheet 2 of 2 only)	0101-00-0584
Schematic	0103-00-0556
Parts List	1100-00-0584
TRIG/PULSE BOARD	
Parts Locater Drawing	0100-00-0565
Assembly Drawing (Sheet 2 of 2 only)	0101-00-0585
Schematic	0103-00-0565
Parts List	1100-00-0585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NO. 4-40 x 1/2" FIL. HEAD SCREW WITH INT. TOOTH LOCK WASHER AND NUT
DS1
R1
E3 (ORN)
E5 (BRN)
E4 (RED)
BNC CONN. (5)
(J5) TO J7 ANGLE FORMING W/P NO. SEE SHT 2 DETAIL VIEW "C"
DETAIL VIEW "A" (FRONT PANEL)
NO. 6-32 x 3/8" PAN HEAD SHEET METAL SCREW (4)
BNC CONN. (2)
(J10 REF.)
F1
(J9 REF.)
NO. 4-40 x 3/8" PAN HEAD SCREW WITH INT. TOOTH LOCK WASHER (3)
SEE DETAIL VIEW "B" (FOR REAR PANEL)
SEE DETAIL VIEW "A" (FOR FRONT PANEL)
P.C. BD. ASS'Y. (0102-00-0556 REF.)
P.C. BD. ASS'Y. (0102-00-0565 REF.)
THERMAL COMPOUND BETWEEN HEAT SINKS AND REAR PANEL
NO. 4-40 x 1/4" PAN HEAD SCREW (8)
DETAIL VIEW "B" REAR PANEL
FOR WIRING SEE DETAIL "D"
SEE DETAIL "D"
J11, FOR WIRING SEE DETAIL "D" SHT 2 OF 2
NO. 6-32 x 3/8" PAN HEAD SCREW WITH NUT
E7, WHT/BLK
E6, GRN
YEL, E26
WHT/BLK, E27
NO. 6-32 x 3/8" PAN HEAD SCREW WITH INT. TOOTH LOCK WASHER AND NUT (2)
NO. 6-32 x 1 1/2" PAN HEAD SCREW WITH INT. TOOTH LOCK WASHER AND NUT (4)
T1 FOR WIRING SEE DETAIL "D" SHT 2 OF 2
NOTE UNLESS OTHERWISE SPECIFIED
REMOVE ALL BURRS AND BREAK SHARP EDGES
MATERIAL
FINISH WAVETEK PROCESS
D. COOPER
11-17-77
PROTECTION
3-23-77
TOLERANCES UNLESS OTHERWISE SPECIFIED
DO NOT SCALE DRWG
WAVETEK SAN DIEGO, CALIFORNIA
ASSEMBLY STANDARD CHASSIS
SIZE A
CAGE CODE 23338
WEIGHT LBS. 14.7
DRW. NO. 0102-00-0549
REV. C
SHEET 1 OF 2

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REASON, EXCEPT CALIBRATION, OPERATION AND
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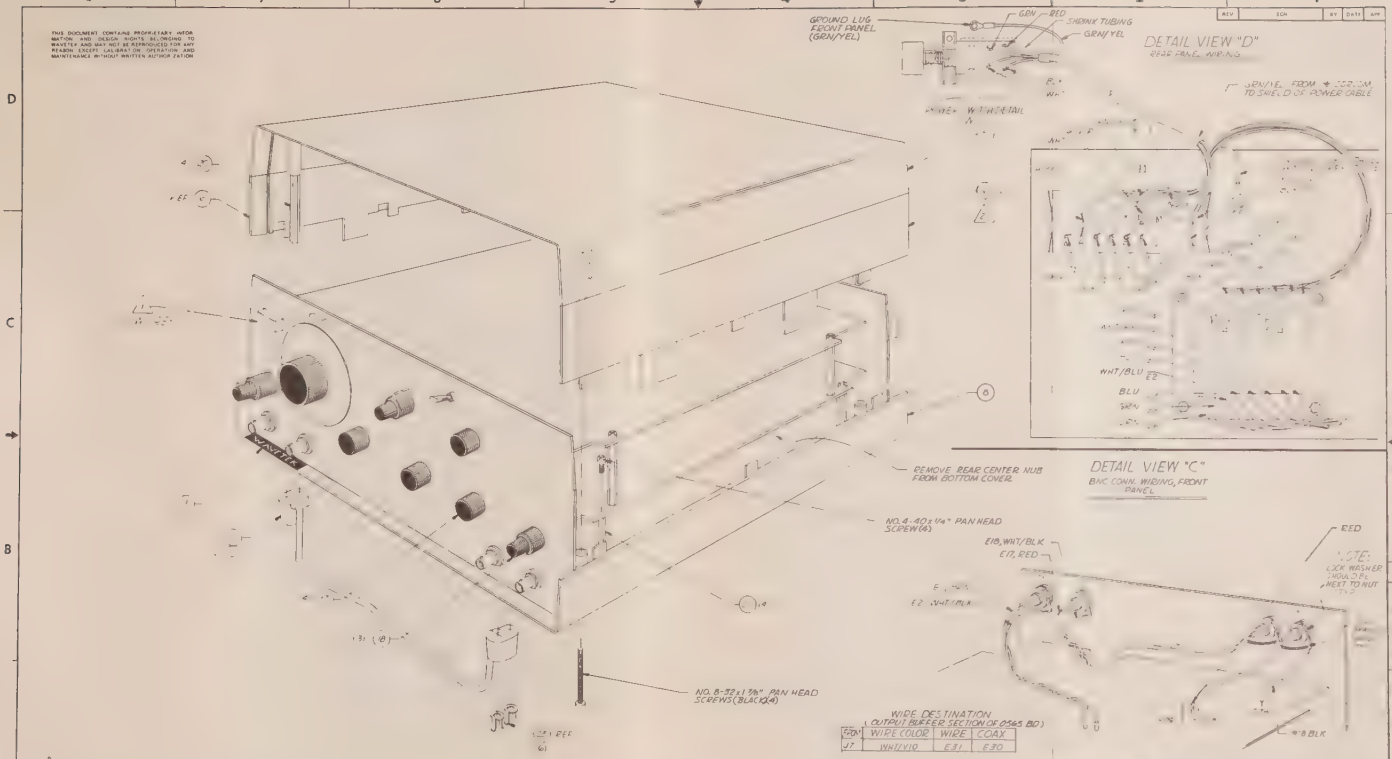


WIRE DESTINATION
(OUTPUT BUFFER SECTION OF 0565 BD)

J7	WIRE COLOR	WIRE	COAX
J7	WHT/VIO	E31	E30

2. CEMENT ITEM 6(8) TO ITEM 5 (TYP BOTH SIDES)

1. MOUNT SWITCH TO P.C. BOARD PRIOR TO INSTALLING FRONT PANEL, USE NO 2-56 x 1/4" PAN HEAD SCREW WITH NUT (2)

NOTE: UNLESS OTHERWISE SPECIFIED

WAVETEK

A M.

STANDARD CHASSIS

DO NOT SCALE DWG

SCALE

MODEL NO. 143

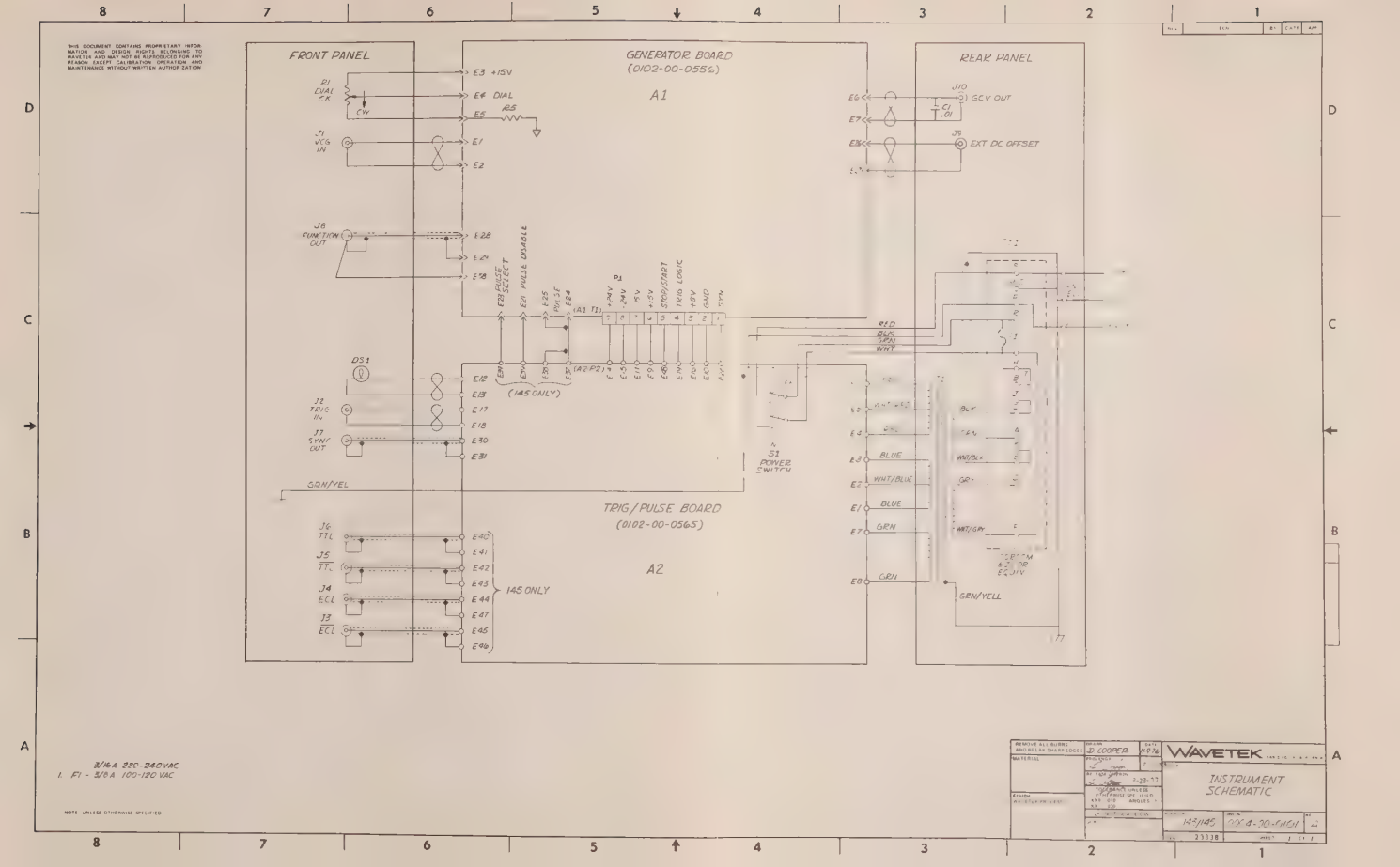
DWG NO. 0102-00-0589

REV A

SERIES 23338

SHT 2 OF 2

VIKING LABORATORIES


FRONT PANEL
GENERATOR BOARD
(0102-00-0556)
A1
REAR PANEL
R1
CVAL
CAL
CW
R5
J1
VCO
IN
E1
E2
E3 +15V
E4 DIAL
E5
J10
VCO OUT
J9
EXT DC OFFSET
J8
FUNCTION
OUT
E28
E29
E38
E21 PULSE ENABLE
E25
E24
P1
+24V
+5V
STROBE/START
TRIG LOGIC
GND
SYN
(A1 T1)
(A2 P2)
DS1
J2
TRIG
IN
J7
SYNC
OUT
E12
E13
E17
E18
E30
E31
(145 ONLY)
S1
POWER
SWITCH
GRN/YEL
TRIG/PULSE BOARD
(0102-00-0565)
A2
J6
TTL
J5
TTL
J4
ECL
J3
ECL
E40
E41
E42
E43
E44
E47
E45
E46
145 ONLY
RED
BLK
WHT
BLUE
WHT/BLU
GRN
WHT/GRN
GRN/YELL
3/16A 220-240VAC
1. F1 - 3/8A 100-120 VAC
NOTE UNLESS OTHERWISE SPECIFIED
WAVETEK
INSTRUMENT
SCHEMATIC
145/1185
00X-4-20-6IM01

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REFERENCE DESIGNATORS	PART DESCRIPTION	MFGR NUMBER/NAME AND NO.	MFGR	WAVETEK NO.	QTY
NONE	ASSY DRAG CHASSIS	0150-00-00589	WAVTK	0102-00-00589	.
1	DIAL ASSY	[illegible]	WAVTK	1201-00-00582	.
T1	TRANSFORMER	1204-00-00574	WAVTK	1204-00-00574	1
2	END BELL	110-333	WAVTK	1400-00-01174	.
3	PLATE,NAME	139-145	WAVTK	1400-00-21180	.
4	INDICATOR,DIAL	180-393	WAVTK	1400-00-00487	1
5	COVER,TOP	180-398-1	WAVTK	1400-00-00509	.
6	EXPANDER	180-361	WAVTK	1400-00-05010	4
7	POST	180-302	WAVTK	1400-00-05020	4
8	COVER,BOTTOM	180-398-2	WAVTK	1400-00-05030	.
21	SHIELD	1400-00-00214	WAVTK	1400-00-00214	.
43	PANEL,REAR	1403-00-00760	WAVTK	1400-00-00760	1
9	PANEL,FRONT	[illegible]	WAVTK	1401-00-00490	.
J2	LABEL,I.D.	[illegible]	WAVTK	[illegible]	.
C1	CAP,ELH,.01MF,50V	[illegible]	CR	[illegible]	1
J1 J10 J2 J7 J8 J9	BNC CONN	[illegible]	MIN	[illegible]	6
J11	RECEPTACLE	[illegible]	[illegible]	[illegible]	1
14	TERM,LUGS LUG	[illegible]	AMP	21-32-00206	1

WAVETEK PARTS LIST

TITLE: 810 CHASSIS

ASSEMBLY NO: [illegible]

PAGE [illegible]

REFERENCE DESIGNATORS	PART DESCRIPTION	MFGR NUMBER/NAME AND NO.	MFGR	WAVETEK NO.	QTY
NONE	WIRE,HU,22GA	[illegible]	GRYTT	6000-32-2004	[illegible]
NONE	WIRE,HU,22GA	[illegible]	GRYTT	6000-32-2005	[illegible]
NONE	WIRE,HU,22GA	[illegible]	GRYTT	6000-32-2065	[illegible]
NONE	WIRE,HU,22GA	[illegible]	GRYTT	6001-32-2000	[illegible]
NONE	CABLE,CU&T,26AWG	MC 17A/C	IT	6001-00-0001	[illegible]
NONE	PWR CORD	[illegible]	MACHO	6001-00-0005	[illegible]

WAVETEK PARTS LIST

TITLE: 810 CHASSIS

ASSEMBLY NO: 1101-00-0589

PAGE [illegible]

REFERENCE DESIGNATORS	PART DESCRIPTION	MFGR NUMBER/NAME AND NO.	MFGR	WAVETEK NO.	QTY
15	TERM,LOCK LUG	[illegible]	SH-HM	2100-00-0000	.
5	SOLDER LUG	[illegible]	SPC	2150-00-0012	8
17	STD KNOB	[illegible]	KNOB	2400-01-0005	4
6	CORE ANJU SET	[illegible]	MISC	2401-01-0009	1
19	LAMP	1T-787B	CEC	[illegible]	.
24	LABEL,RECEPT	PS-1501	[illegible]	24-[illegible]	1
F1	FUSE,125V,1/2A,SB	313,500	LITT	2501-0004-00	1
18	BUMPING MTG,LINER	MLP49	MISC	24-7401-0002	4
20	STANDOFF	[illegible]	SPEP	2501-02-0010	4
21	STANDOFF	[illegible]	SPEP	2501-02-0011	4
22	SCIL ASSY W/FT	180-380	MISC	[illegible]	1
23	SPEEDNUT,SELF RETAI	[illegible]	TRIM	2501-09-0503	4
26	WASHER,SHO.LDED	7AAA	MISC	2530-27-0004	2
3	SWITCH ASSY PB	5102-05-00U8	MISC	5102-00-0008	1
NONE	WIRE,HU,18GA	18GA/BLACK	MISC	6000-31-4000	1
NONE	WIRE,HU,22GA	1% BROWN	GRYTT	6000-32-2001	.
NONE	WIRE,HU,22GA	[illegible]	GRYTT	6000-32-2002	.
NONE	WIRE,HU,22GA	1% ORANGE	GRYTT	6000-32-2003	.

WAVETEK PARTS LIST

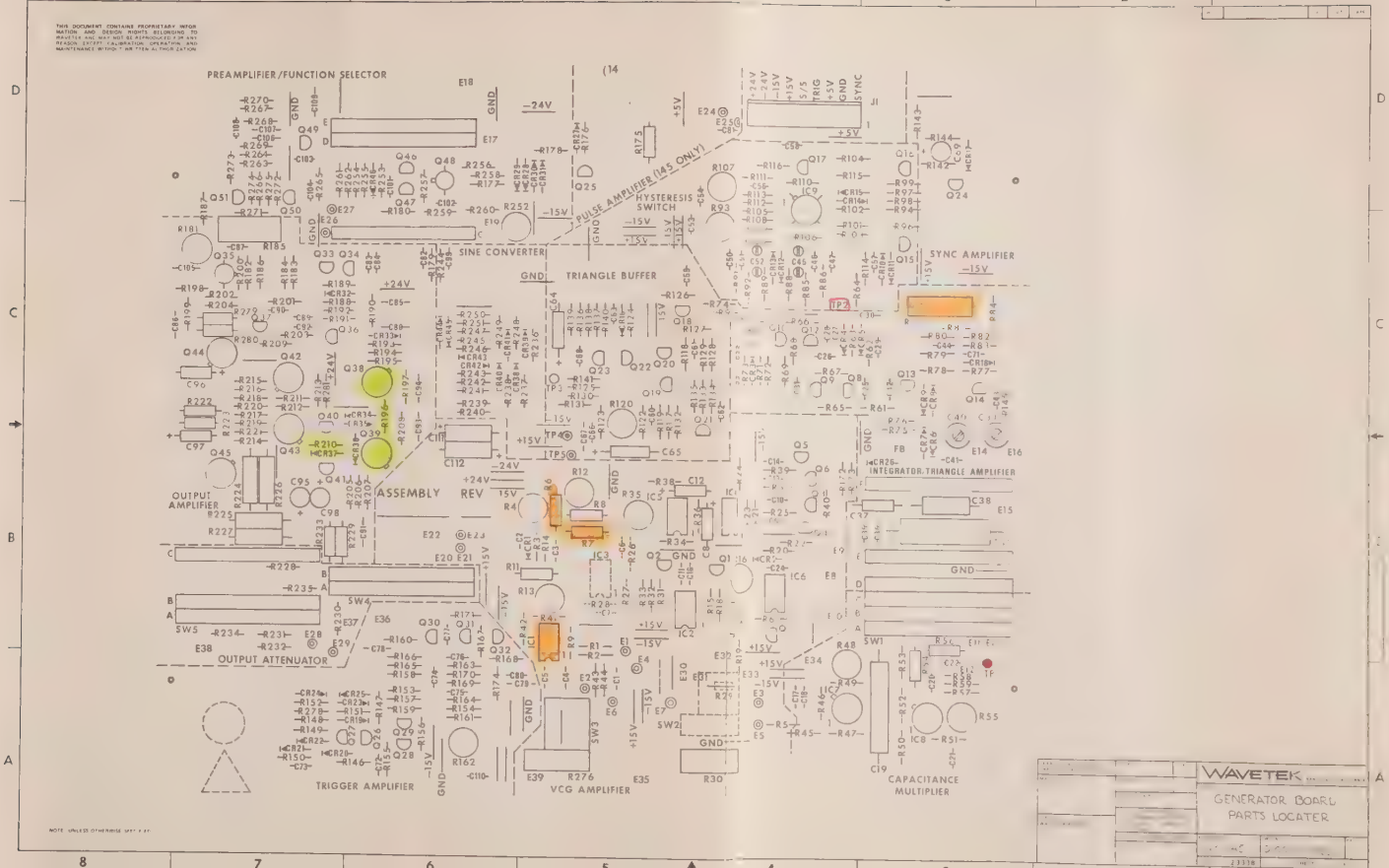
TITLE: 810 CHASSIS

ASSEMBLY NO: 1101-00-0589

PAGE 2

NOTE: UNLESS OTHERWISE SPECIFIED

			WAVETEK		
				1101 00 0589	E
			23338		


PREAMPLIFIER/FUNCTION SELECTOR
PULSE AMPLIFIER (145 ONLY)
HYSTERESIS SWITCH
SINE CONVERTER
TRIANGLE BUFFER
SYNC AMPLIFIER
INTEGRATOR/TRIANGLE AMPLIFIER
OUTPUT AMPLIFIER
ASSEMBLY REV
OUTPUT ATTENUATOR
TRIGGER AMPLIFIER
VCG AMPLIFIER
CAPACITANCE MULTIPLIER
WAVETEK
GENERATOR BOARD PARTS LOCATER

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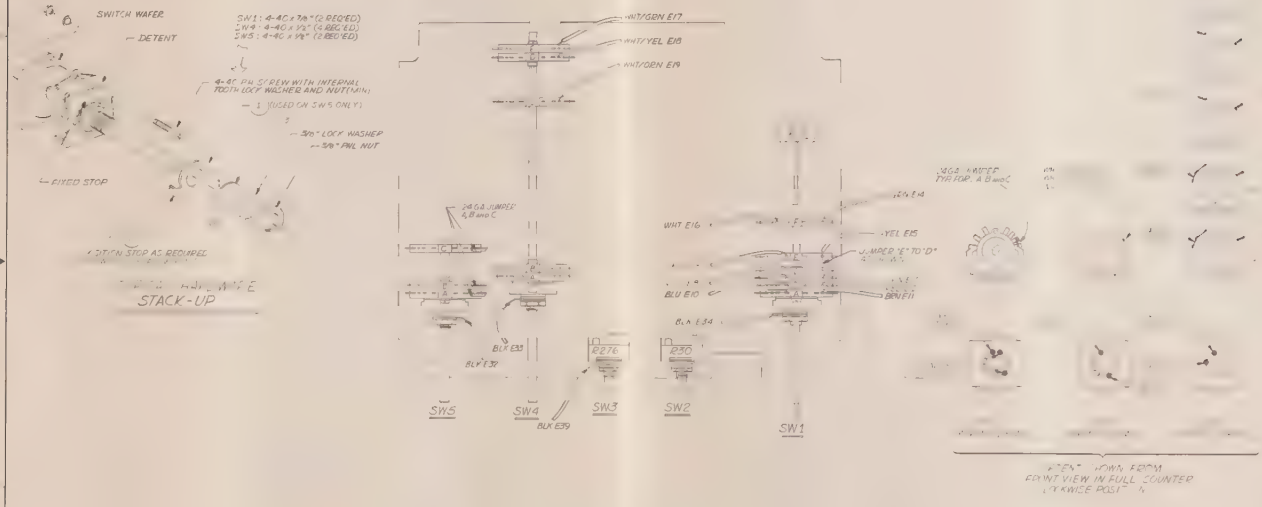


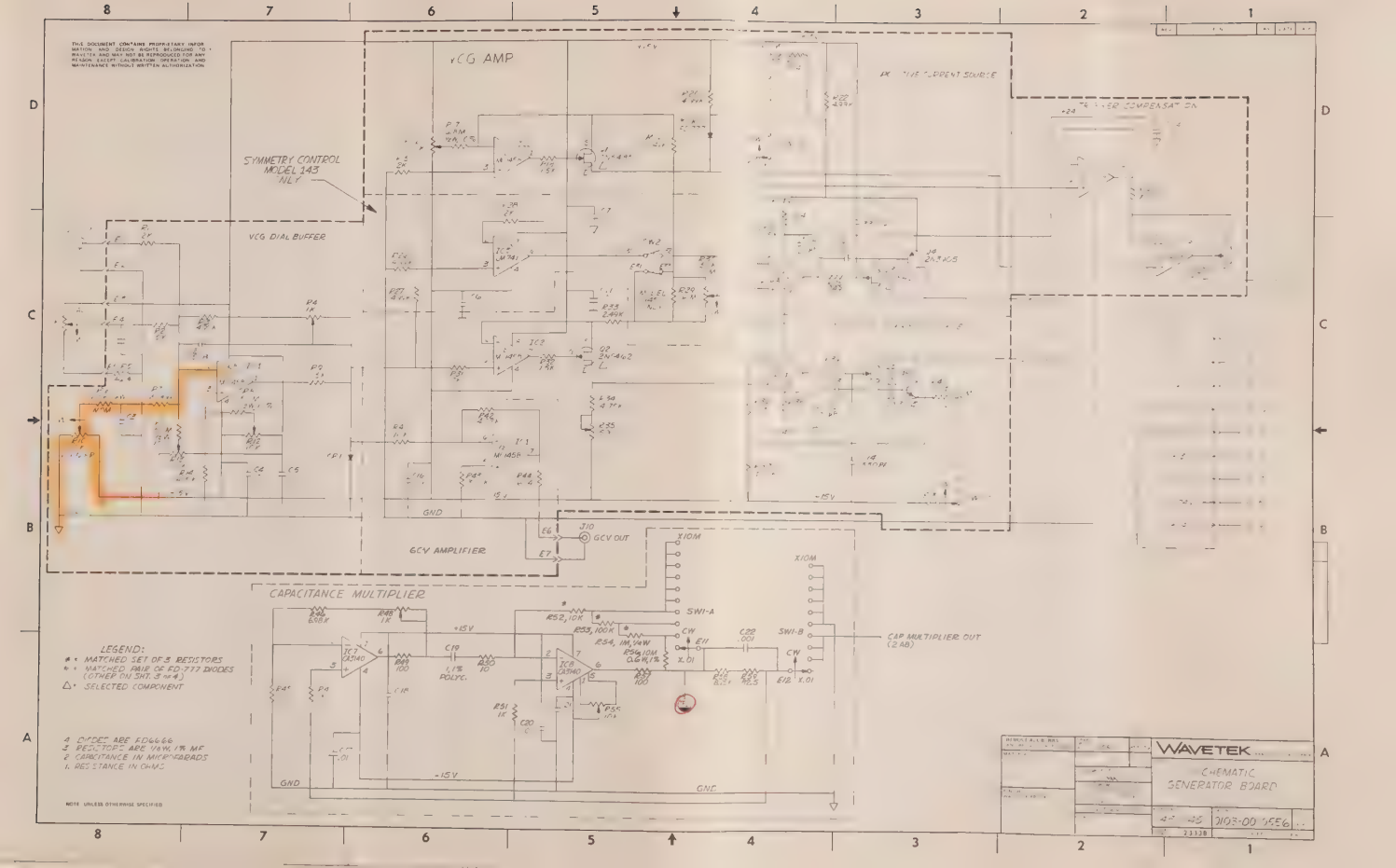
TURN TO FULL COUNTER CLOCKWISE POSITION, THEN TURN BACK CLOCKWISE ONE " POSITION TO INSTALL BOTH STOPS.

NOTE: UNLESS OTHERWISE SPECIFIED

WAVETEK

ASSEMBLY GENERATOR BOARD

23330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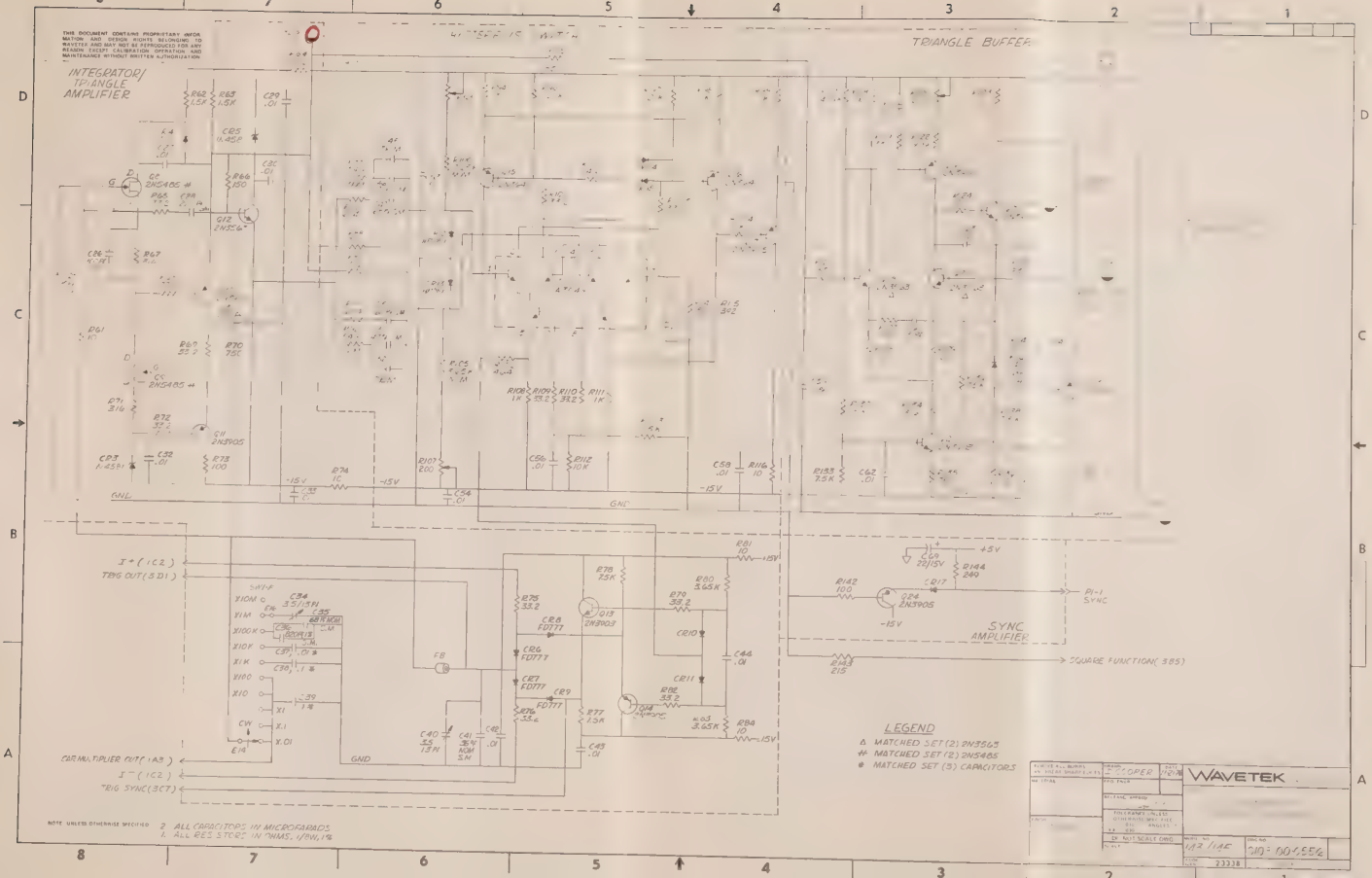
VCG AMP
SYMMETRY CONTROL MODEL 143 ONLY
VCG DIAL BUFFER
GCV AMPLIFIER
GCV OUT
J10
CAPACITANCE MULTIPLIER
SWI-A
SWI-B
CAP MULTIPLIER OUT (2 AB)
XIOM
GND
+15V
-15V
LEGEND:
* MATCHED SET OF 3 RESISTORS
** MATCHED PAIR OF FD777 DIODES (OTHER DIODE IS NOT *)
SELECTED COMPONENT
4. DIODE ABE FD666
3. RESISTORS ABE 1/4W 1% MF
2. CAPACITANCE IN MICROFARADS
1. RESISTANCE IN OHMS
NOTE UNLESS OTHERWISE SPECIFIED
WAVETEK
SCHEMATIC
GENERATOR BOARD
2103-00 REV E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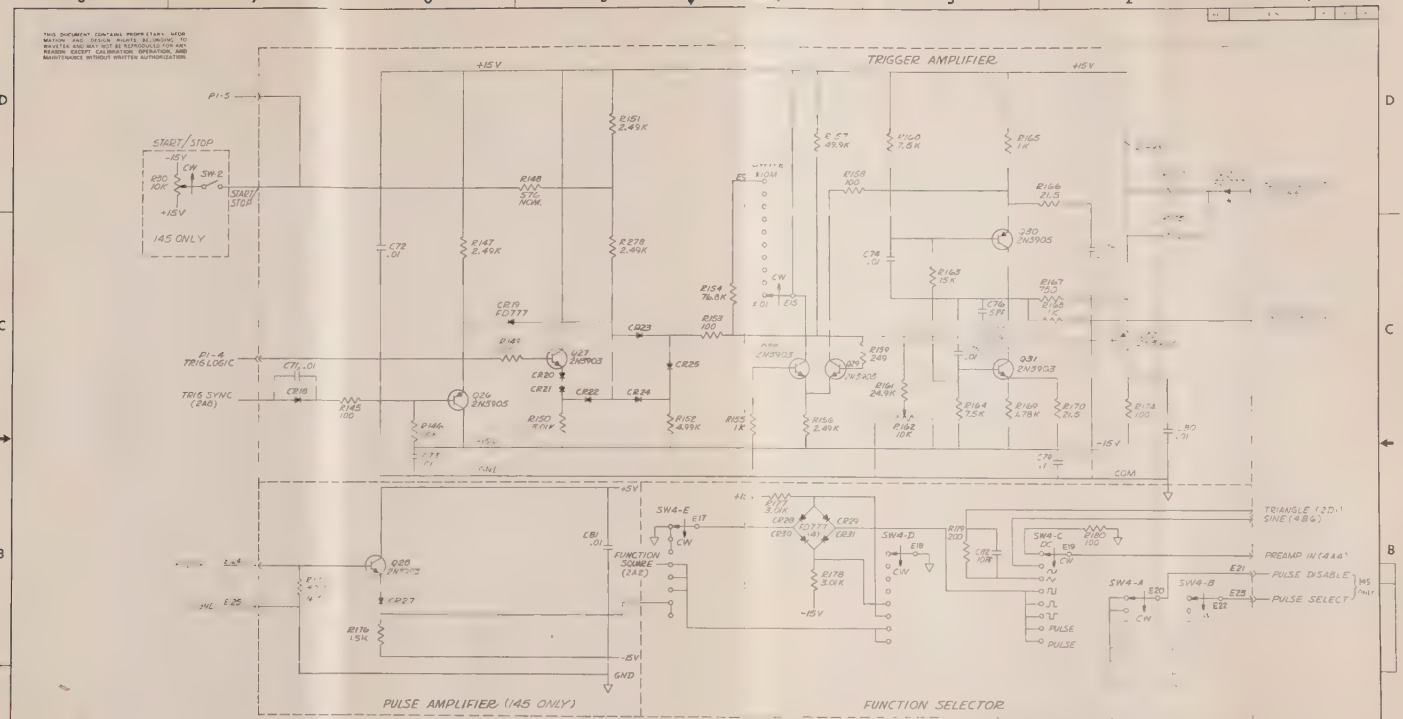
INTEGRATOR/ TRIANGLE AMPLIFIER
TRIANGLE BUFFER
SYNC AMPLIFIER
LEGEND
Δ MATCHED SET (2) 2N3563
MATCHED SET (2) 2N5485
* MATCHED SET (3) CAPACITORS
NOTE: UNLESS OTHERWISE SPECIFIED 2. ALL CAPACITORS IN MICROFARADS. 1. ALL RES. STORS. IN OHMS, 1/8W, 1%
WAVETEK
23338



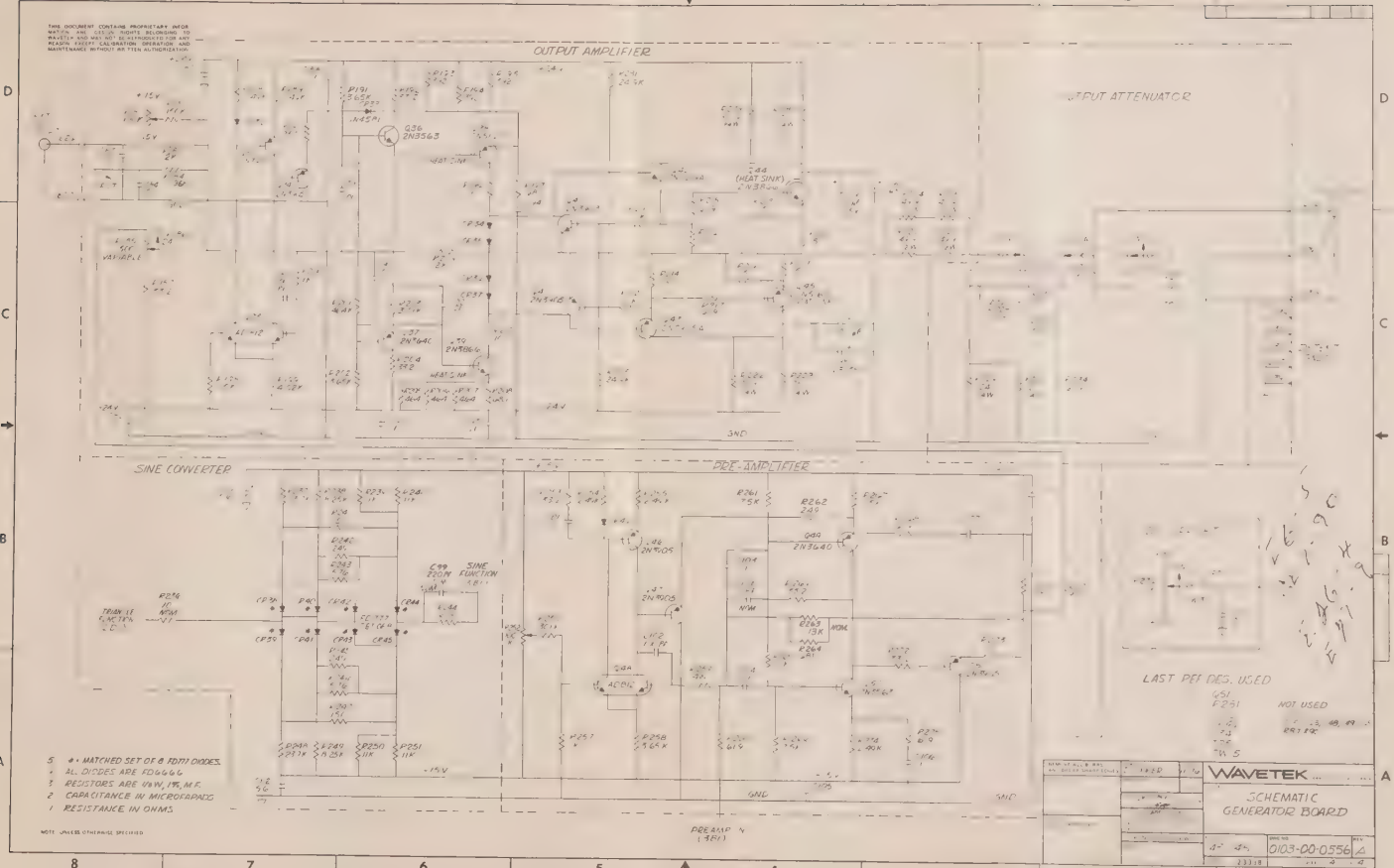
5.) DIODES ARE FD6666
4. RESISTORS ARE ½W, 1%, MF
3. CAPACITANCE IN MICROFARADS
2. RESISTANCE IN OHMS
1. * MATCHED PAIR OF FD777 (OTHER ON SHT. 1)

NOTE: UNLESS OTHERWISE SPECIFIED

WAVETEK

SCHEMATIC GENERATOR BOARD

03 00 0556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OUTPUT AMPLIFIER
OUTPUT ATTENUATOR
SINE CONVERTER
PRE-AMPLIFIER
SINE FUNCTION ADJ.
LAST PEF DES. USED
NOT USED
5 ⊕ - MATCHED SET OF 8 FD711 DIODES.
4 ALL DIODES ARE FD6666
3 RESISTORS ARE ½W, 1%, M.F.
2 CAPACITANCE IN MICROFARADS
1 RESISTANCE IN OHMS
NOTE UNLESS OTHERWISE SPECIFIED
WAVETEK
SCHEMATIC
GENERATOR BOARD
0103-00-0556
A

THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION AND DESIGN RIGHTS RELATING TO WAVETEK AND MAY NOT BE USED FOR ANY PURPOSE EXCEPT INSTALLATION, OPERATION AND MAINTENANCE WITHOUT WRITTEN AUTHORIZATION

REFERENCE DESIGNATORS	PART DESCRIPTION	WAVETEK NO.	QTY.
NONE	ASSY DRAG GENERATOR	0101-00-0584	1
NONE	SCHEMATIC GENERATOR	0103-00-0554	1
C1081 C61 C76 C77	CAP,CER,5PF,1KV	00-050	CWL
C59 C82	CAP,CER,10PF,1KV	00-100	CWL
C102 C67	CAP,CER,100PF,1KV	00-101	CWL
C13 C22 C63 C9	CAP,CER,.001MF,1KV	00-102	CWL
C1 C101 C103 C104 C11 C110 C14 C17 C18 C20 C21 C24 C27 C29 C3 C30 C32 C33 C4 C42 C43 C44 C5 C53 C54 C56 C57 C58 C6 C60 C7 C71 C72 C73 C74 C75 C80 C81 C82 C90 C91 C94	CAP,CER,.01MF,50V	CK-103	CWL
C105 C106 C107 C109 C47 C48 C49 C85 C86 C88 C93 C95 C96	CAP,CER,.1MF,50V	CK-104	CWL
L2	CAP,CER,150PF,1KV	00-151	CWL
C10 C16	CAP,CER,330PF,1KV	00-331	CWL
C24	CAP,MICA,100PF,500V	CM15-101J	AMCO
C25	CAP,MICA,150PF,500V	CM15-151J	AMCO
C20 C31 C98	CAP,MICA,220PF,500V	CM15-221J	AMCO

WAVETEK PARTS LIST — TITLE PCA,GENERATOR — ASSEMBLY NO 1100-00-0584 — REV A — PAGE: 1

REFERENCE DESIGNATORS	PART DESCRIPTION	WAVETEK NO.	QTY.
	CAP,SET-PO,1C CONSIST:1509-40-0005 THRU:0007	1509-00-0000	
C39	CAP,POLYE,1MF,100V PART OF 1509-00-0008 QTY:011		
NONE	GENERATOR	1700-00-0556	WAVE
NONE	CONN,4PIN	09-40-1091	MOLEX
NONE	SOLDER LUG	1497	SMITH
NONE	TERM	200881	UNICO
NONE	PIN,HALL	611B2-2	EMP
NONE	HEAT SINK	HF-207	WAKE
NONE	TRANSIPAD	10123A	METRX
NONE	TRANSIPAD	10160	METRX
NONE	HEATSINK	HF-209	WAKE
FB1	FERRITE BEAD	56-590-65/3B	FERRX
R4 R48	POT,TRIM,1K	91AM1K	BECK
R12 R162 R55	POT,TRIM,10K	91AM10K	BECK
R13 R16 R181 R252	POT,TRIM,100K	91AM100K	BECK
R107 R120 R43	POT,TRIM,200	91AM200	BECK

WAVETEK PARTS LIST — TITLE PCA,GENERATOR — ASSEMBLY NO 1100-00-0584 — REV A — PAGE: 3

REFERENCE DESIGNATORS	PART DESCRIPTION	WAVETEK NO.	QTY.
R239 R240 R250 R251	RES,MF,1/8W,1%,11K	RN55D-1102F	TRW
R94 R97	RES,MF,1/8W,1%,2.21K	RN55D-2211F	TRW
R263?	RES,MF,1/8W,1%,13K	RN55D-1302F	TRW
R110 R241 R247 R66	RES,MF,1/8W,1%,150	RN55D-1500F	TRW
R113 R18 R100 R23 R167 ~32 R35 R47 R61 R80	RES,MF,1/8W,1%,1.5K	RN55D-1501F	TRW
R132 R165 R2	RES,MF,1/8W,1%,15K	RN55D-1502F	TRW
R102	RES,MF,1/8W,1%,150K	RN55D-1503F	TRW
R218 R219 R228 R221	RES,MF,1/8W,1%,15	RN55D-15R0F	TRW
R169	RES,MF,1/8W,1%,1.78K	RN55D-1781F	TRW
R104	RES,MF,1/8W,1%,1.96K	RN55D-1961F	TRW
R170	RES,MF,1/8W,1%,20K	RN55D-2000F	TRW
R1 R15 R183 R209 R20 R31	RES,MF,1/8W,1%,2?	RN55D-2001F	TRW
R143	RES,MF,1/8W,1%,215	RN55D-2150F	TRW
R166 R170	RES,MF,1/8W,1%,23.2K	RN55D-2322F	TRW
R257 R266	RES,MF,1/8W,1%,237K	RN55D-2372F	TRW
R102 R137 R144 R159 R166 R230 R242 R245 R247 R250 R255	RES,MF,1/8W,1%,249	RN55D-2490F	TRW

WAVETEK PARTS LIST — TITLE PCA,GENERATOR — ASSEMBLY NO 1100-00-0584 — REV A — PAGE: 5

REFERENCE DESIGNATORS	PART DESCRIPTION	WAVETEK NO.	QTY.
C117	CAP,MICA,36PF,500V	DM15-360J	AMCO
C44 C51	CAP,MICA,47PF,500V	DM15-470J	AMCO
C55? C67 C50	CAP,MICA,68PF,500V	DM15-680J	AMCO
C5a	CAP,MICA,820PF,500V	DM15-821F	AMCO
	CAP,POLYE,1MF,100V	214-91C-105F	IMC
C28 C40	VAR1,3.5-13PF,250V	73-1H1A0-02 3.5/13PF	JOHN
C12 C8 C46 C97	CAP,TANT,1MF,35V	150D105X9035A2	SPRAG
C07	CAP,TANT,22MF,15V	196D226X9015KA1	SPRAG
C45 C90	CAP,TANT,27MF,25V	196D276X9025F8	SPRAG
C111 C112 C64 C69	CAP,TANT,5.6MF,35V	150D565X9035B2	SPRAG
		199-501-101	MYLR
C37	CAP,POLYE,.01MF,100V PART OF 1509-00-0008 QTY:011		
C38	CAP,POLYE,.1MF,100V PART OF 1509-00-0008 QTY:011		

WAVETEK PARTS LIST — TITLE PCA,GENERATOR — ASSEMBLY NO 1100-00-0584 — REV A — PAGE: 2

REFERENCE DESIGNATORS	PART DESCRIPTION	WAVETEK NO.	QTY.
R35	POT,TRIM,5K	91AM500	BECK
R27a	POT,SWITCH,10K	GM=1679	CTS
R30	POT,SWITCH,50K	LM=4900	CTS
R10	POT,CONT;10K FROM:6609-71-0501	6609-71-0501	MVTA
4105	POT,CONT,50R FROM:6609-75-0101	6609-75-0101	MVTA
R11 R8	RES,C;1/2W,103,5.1M	HC2G5F-515	STAPL
R17	RES,C;1/2W,103,6.8M	HC2G5F-685	STAPL
R118 R124 R127 R129 R129 R142 R145 R149 R151 R156 R174 R180 R214 R216 R49 R57 R73	RES,MF,1/8W,1%,100	RN55D-1000F	TRW
R104 R108 R111 R155 R163 R168 R200 R257 R45 R47 R51 R54 R98 R99	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW
R112 R164 R245 R41	RES,MF,1/8W,1%,10K	RN55D-1002F	TRW
R116 R123 R126 R141 R172 R173 R184 R210 R230 R24 R273 R58 R59 R61 R64 R74 R81 R86	RES,MF,1/8W,1%,10	RN55D-10R0F	TRW
R211 R212	RES,MF,1/8W,1%,1.1K	RN55D-1101F	TRW

WAVETEK PARTS LIST — TITLE PCA,GENERATOR — ASSEMBLY NO 1100-00-0584 — REV A — PAGE: 4

REFERENCE DESIGNATORS	PART DESCRIPTION	WAVETEK NO.	QTY.
R147 R151 R154 R171 R188 R189 R19 R25a R255 R274 R278 R33	RES,MF,1/8W,1%,2.49K	RN55D-2491F	TRW
R181 R213 R281	RES,MF,1/8W,1%,24.9K	RN55D-2492F	TRW
R150 R177 R178 R203 R43	RES,MF,1/8W,1%,301K	RN55D-3013F	TRW
R131 R256	RES,MF,1/8W,1%,301K	RN55D-3013F	TRW
R156 R67 R71 R88 R89	RES,MF,1/8W,1%,316	RN55D-3160F	TRW
R101 R103 R104 R110 R119 R124 R13x R140 R187 R192 R204 R243 R249 R272 R65 R68 R69 R74 R75 R76 R79 R82 R95	RES,MF,1/8W,1%,33.2	RN55D-33R2F	TRW
R100 R105 R191 R202 R258 R66 R93	RES,MF,1/8W,1%,365K	RN55D-3651F	TRW
R115 R193 R194 R195	RES,MF,1/8W,1%,392	RN55D-3920F	TRW
R199 R42	RES,MF,1/8W,1%,402K	RN55D-4021F	TRW
R186 R2W5 R206 R207	RES,MF,1/8W,1%,464	RN55D-4640F	TRW
R201	RES,MF,1/8W,1%,46.4K	RN55D-4642F	TRW
R5	RES,MF,1/8W,1%,49.4	RN55D-49R4F	TRW
R34	RES,MF,1/8W,1%,4.75K	RN55D-4751F	TRW

WAVETEK PARTS LIST — TITLE PCA,GENERATOR — ASSEMBLY NO 1100-00-0584 — REV A — PAGE: 6

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES

DO NOT SCALE DWG

WAVETEK SAN DIEGO, CALIFORNIA

GENERATOR

SCALE — MODEL NO 143 — DWG NO 1100-00-0584 — REV A — SHEET 1 OF 2

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	MANUFACTURER	MFR	MANUFACTURER NO.	QTY
R231 R259	RES,MF,1/8W,1%,499	RN550-4990F	TRW	4701-03-4990	2
R117 R14 R152 R20 R22 R232 R26 R29 R3 R37	RES,MF,1/8W,1%,1.99K	RN550-4991F	TRW	4701-03-4991	10
R157	RES,MF,1/8W,1%,49.9K	RN550-4992F	TRW	4701-03-4992	1
R251 R421	RES,MF,1/8W,1%,54.9	RN550-5409F	TRW	4701-03-5409	2
R235	RES,MF,1/8W,1%,54.9	RN550-54R9F	TRW	4701-03-54R9	1
R1481 R241 R246	RES,MF,1/8W,1%,576	RN550-5760F	TRW	4701-03-5760	3
R21 R40 R66 R84 R91	RES,MF,1/8W,1%,608	RN550-6080F	TRW	4701-03-6080	5
R215 R217 R236 R266 R260 R268 R275	RES,MF,1/8W,1%,81.9	RN550-81N9	TRW	4701-03-8199	7
R264 R270	RES,MF,1/8W,1%,681	RN550-6810F	TRW	4701-03-6810	2
R197 R208	RES,MF,1/8W,1%,681	RN550-6811F	TRW	4701-03-6811	2
R86	RES,MF,1/8W,1%,976	RN550-9761F	TRW	4701-03-9761	1
R135 R167 R190 R62 R76	RES,MF,1/8W,1%,750	RN550-7501	TRW	4701-03-7501	5
R133 R134 R138 R140 R144 R261 R266 R77 R76	RES,MF,1/8W,1%,7.5K	RN550-7501F	TRW	4701-03-7501	6
R254	RES,MF,1/8W,1%,78.7K	RN550-7872F	TRW	4701-03-7872	1
R225	RES,MF,1/8W,1%,825	RN550-8250F	TRW	4701-03-8250	1

WAVETEK PARTS LIST — TITLE: PCB,GENERATOR — ASSEMBLY NO 1160-00-0584 — REV A — PAGE 7

REFERENCE DESIGNATORS	PART DESCRIPTION	MANUFACTURER	MFR	MANUFACTURER NO.	QTY
	RES,MF,1%,MATCHED CONSIST OF R99 00-0063 THRU 01-05			4788-88-0063	
RS4	RES,MF,1/8W,1%,1M PART OF 4788-00-0063 QTY 1 01-1004				
R56	RES,MF,1/8W,1%,10M	MIL-R81	CAPOO	4799-00-0003	1
CR1A CR3 C431 C44 CR5	DIODE	1N4581	MICRO	4801-01-4581	5
CR19 CR20 CR28 C430 CR31 CR6 CR7 CR8 CR9	DIODE	FD-777	FAIR	4807-02-4777	9
CR1 CR10 CR11 CR16 CR17 CR18 CR22 CR23 CR24 CR25 CR32 CR34 CR35 CR36 CR37 CR46	DIODE	FD-6666	FAIR	4807-02-6666	19
CR12 CR13	DIODE	5082-2811	HP	4809-02-2811	2
CR2 CR26	DIODE,M-PP,FD-777 QTY 2 00-2777	1N4-581-93	MVTA	4898-00-0004	1
C434 CR38 CR39 C4-1 C442 CR43 CR44 CR45	DIODE,SEL,4-PP-777 QTY 1 01-6177	1N2-500-98	MVTA	4899-00-0018	1
U42	TRANS	2N2194	FAIR	4901-02-2191	1
Q43	TRANS	2N2904	FAIR	4901-02-9051	1
Q12 Q34 Q58	TRANS	2N3583	FAIR	4901-03-3583	3

WAVETEK PARTS LIST — TITLE: PCB,GENERATOR — ASSEMBLY NO 1160-00-0584 — REV A — PAGE 9

REFERENCE DESIGNATORS	PART DESCRIPTION	MANUFACTURER	MFR	MANUFACTURER NO.	QTY
SW5	LATENT MOD #RUM1584-01-0010		MVTA	5184-99-0029	1
SW6	LATENT MOD #RUM1584-01-0010		MVTA	5184-99-0030	1
NONE	WIRE,MU,2264		GAVTI	6000-32-2000	1
NONE	WIRE,MU,2264		GAVTI	6000-32-2001	1
NONE	WIRE,MU,2264		GAVTI	6000-32-2002	1
NONE	WIRE,MU,2264		GAVTI	6000-32-2003	1
NONE	WIRE,MU,2264		GAVTI	6000-32-2004	1
NONE	WIRE,MU,2264		GAVTI	6000-32-2005	1
NONE	WIRE,MU,2264		GAVTI	6000-32-2006	1
NONE	WIRE,MU,2264		GAVTI	6000-32-2007	1
NONE	WIRE,MU,2264		GAVTI	6000-32-2008	1
NONE	WIRE,MU,2264		GAVTI	6000-32-2009	1
NONE	WIRE,MU,2264		GAVTI	6000-32-2001	1
NONE	WIRE,MU,2264		GAVTI	6000-32-2002	1
NONE	WIRE,MU,2264		GAVTI	6000-32-2003	1
NONE	WIRE,MU,2264		GAVTI	6000-32-2004	1
NONE	WIRE,MU,2264		GAVTI	6000-32-2005	1

WAVETEK PARTS LIST — TITLE: PCB,GENERATOR — ASSEMBLY NO 1160-00-0584 — REV A — PAGE 11

REFERENCE DESIGNATORS	PART DESCRIPTION	MANUFACTURER	MFR	MANUFACTURER NO.	QTY
R238 R249 R58	RES,MF,1/8W,1%,4.64K	RN550-4641F	TRW	4701-03-4251	3
R59	RES,MF,1/8W,1%,42.5	RN55U-42R5F	TRW	4701-03-4259	1
Y 22 R220	RES,MF,1/8W,1%,909	RN551-9090F	TRW	4701-03-9090	2
R231	RES,MF,1/8W,1%,90.9	RN550-9049F	TRW	4701-03-9099	1
R7	RES,MF,1/8W,1%,1M	RN600-1006F	TRW	4701-13-1006	1
R233	RES,MF,1/8W,1%,1211	RN600-1211F	TRW	4701-13-1210	1
R239	RES,MF,1/8W,1%,124	RN600-1240F	TRW	4701-13-1240	1
R222 R219	RES,MF,1/8W,1%,89.9	RN601-8989F	TRW	4701-13-8999	2
R47	RES,MF,1/8W,1%,8498	RN600-8483F	TRW	4701-13-8481	1
R223 R260	RES,MF,1/8W,1%,75	RN600-75R0F	TRW	4701-13-7500	2
R224 R225 R226 R227	RES,MF,1/8W,1%,69.8	RN65U-6909F	TRW	4701-23-6999	4
	RES,MF,SET,MATCHED CONSIST OF 4784-00-0043 THRU 01-0005	4784-00-0043	MVTA	4784-00-0043	1
R52	RES,MF,1/8W,1%,10K PART OF 4784-00-0043 QTY 01-1002				
R53	RES,MF,1/8W,1%,10K PART OF 4784-00-0043 QTY 01-1003				

WAVETEK PARTS LIST — TITLE: PCB,GENERATOR — ASSEMBLY NO 1160-00-0584 — REV A — PAGE 8

REFERENCE DESIGNATORS	PART DESCRIPTION	MANUFACTURER	MFR	MANUFACTURER NO.	QTY
D15 D16 D37 D49	TRANS	2N3640	FAIR	4901-03-4640	4
Q39 Q46	TRANS	2N3906	MOT	4901-03-9060	2
Q13 Q21 Q22 Q27 Q28 Q29 Q31 Q40 Q6	TRANS	2N3905	FAIR	4901-03-9050	9
Q10 Q11 Q14 Q17 Q19 Q24 Q26 Q30 Q32 Q33 Q36 R4 Q41 Q48 Q47 Q51	TRANS	2N3905	FAIR	4901-03-9050	17
D38 D45	TRANS	2N5160	MOT	4901-05-1600	2
D18 Q20	TRANS,M-PP,2N3563 QTY 02-4901-03-5630	1N2-501-42	MVTA	4898-00-0004	1
Q2 Q3 Q7	TRANS,SEL,2N5962 QTY 01-4901-05-4629	1N2-501-55	MVTA	4898-00-0008	3
Q8 Q9	TRANS,M-PP,2N5833 QTY 02-4901-03-5831	1N2-501-93	MVTA	4898-00-0009	1
Q1 Q5	TRANS,SEL,2N5895 QTY 01-4901-05-4850	1N2-501-50	MVTA	4898-00-0010	2
NONE	PAPER	167-480	MVTA	5104-02-0815	16
NONE	SWITCH STOP	211-13-001	CTS	5104-07-0001	1
NONE	SWITCH STOP	215-13-001-01-22	CTS	5104-07-0003	1
SW1	DETENT MOD #RUM1584-01-0010	5104-99-0028	MVTA	5104-99-0028	1

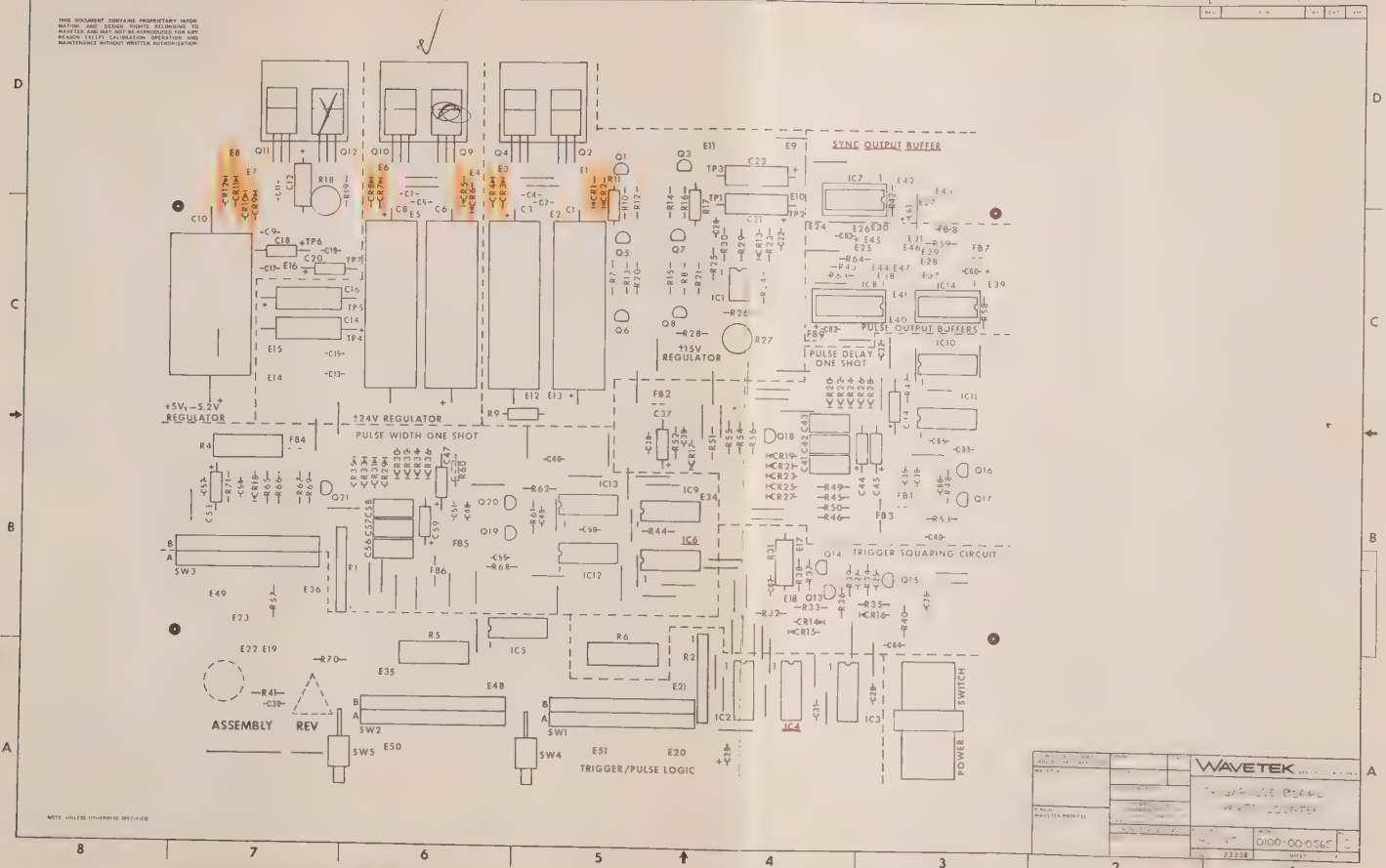
WAVETEK PARTS LIST — TITLE: PCB,GENERATOR — ASSEMBLY NO 1160-00-0584 — REV A — PAGE 10

REFERENCE DESIGNATORS	PART DESCRIPTION	MANUFACTURER	MFR	MANUFACTURER NO.	QTY
IC3 IC4 IC5	IC	NE-592	SIGN	7000-07-4100	3
U35 U48	IC	NE 912	ANLEX	7000-08-2200	2
IC1 IC2 IC6	IC	MC1595P	MOT	7000-14-5800	3
IC9	IC	C4-3069	MCA	7000-32-4900	1
IC7 IC8	IC	C451458	MCA	7000-51-8001	2

WAVETEK PARTS LIST — TITLE: PCB,GENERATOR — ASSEMBLY NO 1160-00-0584 — REV A — PAGE 12

NOTE UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES	FINISH	DATE	WAVETEK
MATERIAL			TITLE
DO NOT SCALE DWG	MODEL NO 143	DWG NO 1160-00-0584	REV 1
SCALE	CODE IDENT NO 23338	SHEET 2 OF 2	


SYNC OUTPUT BUFFER
PULSE OUTPUT BUFFERS
PULSE DELAY ONE SHOT
+15V REGULATOR
+5V1 -5.2V REGULATOR
±24V REGULATOR
PULSE WIDTH ONE SHOT
TRIGGER SQUARING CIRCUIT
ASSEMBLY
REV
SW1
SW2
SW3
SW4
SW5
POWER SWITCH
TRIGGER/PULSE LOGIC
IC1
IC2
IC3
IC4
IC5
IC6
IC7
IC8
IC9
IC10
IC11
IC12
IC13
IC14
WAVETEK
0100-00-056C

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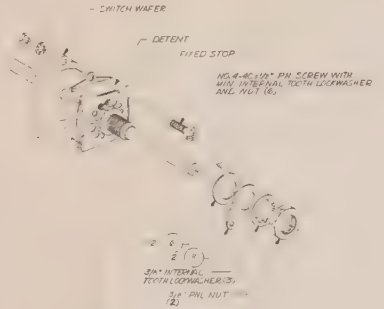
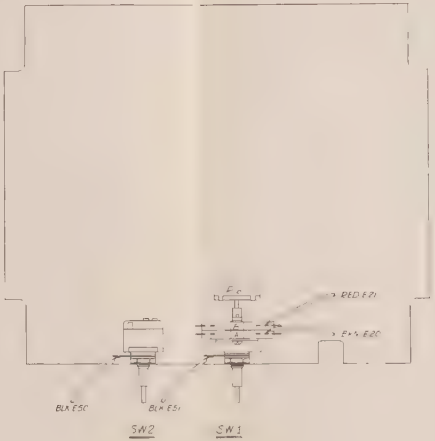
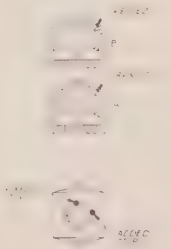

SWITCH WAFER
DETENT
FIXED STOP
NO.4-40 x 1/2" PH. SCREW WITH WIDE INTERNAL TOOTH LOCKWASHER AND NUT (6).
3/8" INTERNAL TOOTH LOCKWASHER (3).
3/8" PHL NUT (2).

TYPICAL HARDWARE STACK-UP

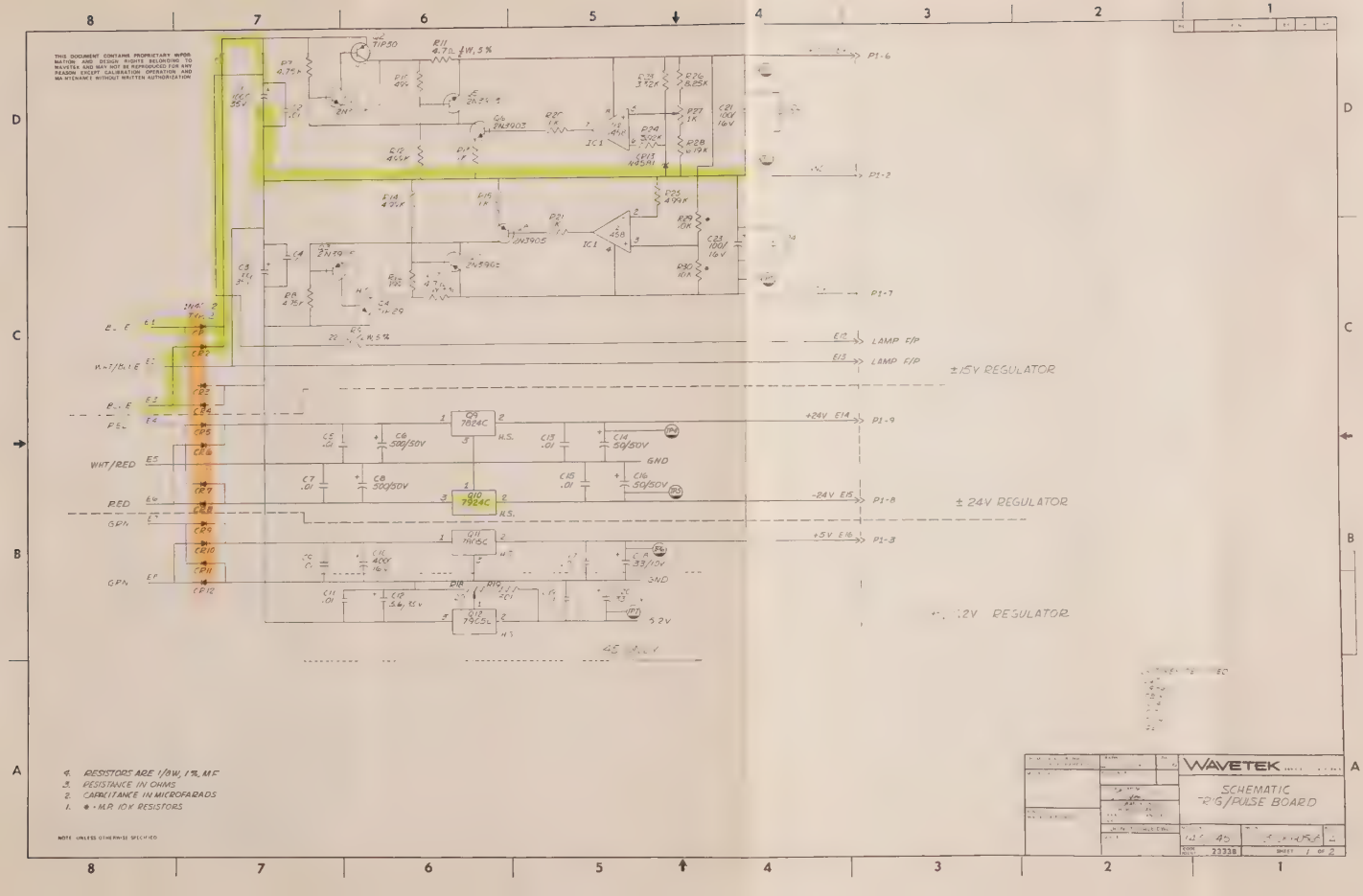




DETENT SHOWN FROM FRONT VIEW IN FULL COUNTER CLOCKWISE POSITION

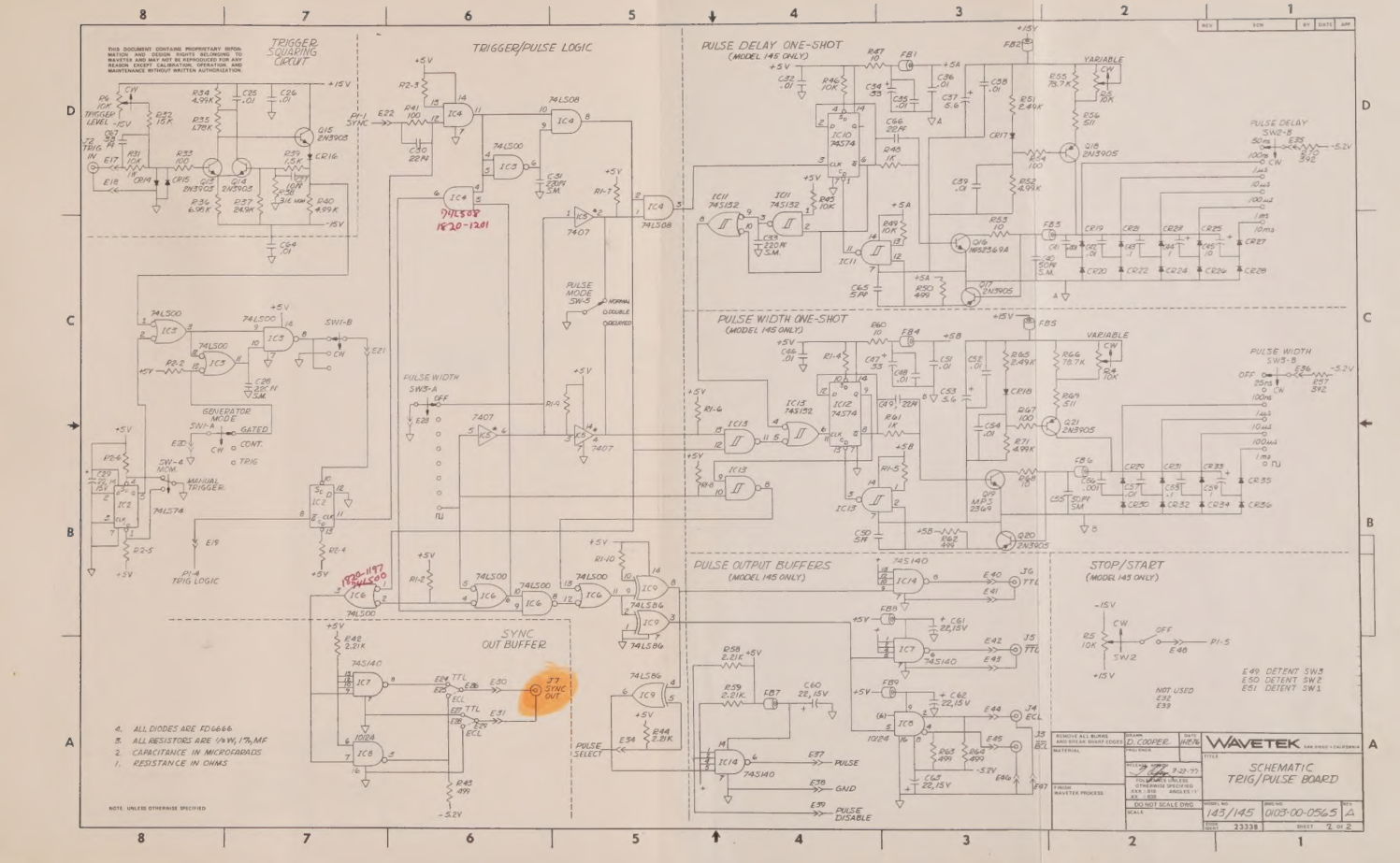
NOTE UNLESS OTHERWISE SPECIFIED

DRAWN	D COOPER	WAVETEK	
ASSEMBLY TRIG/PULSE BD.			
MODEL NO.	143	DWG. NO.	143-00-0[illegible]
SERIAL NO.	23338	REV.	L
		SHT.	2 OF 2



1. RESISTORS ARE 1/8W, 1%, M.F.
2. RESISTANCE IN OHMS
3. CAPACITANCE IN MICROFARADS
4. ● = M.P. 10K RESISTORS

NOTE UNLESS OTHERWISE SPECIFIED


TRIGGER SQUARING CIRCUIT
TRIGGER/PULSE LOGIC
PULSE DELAY ONE-SHOT
(MODEL 145 ONLY)
PULSE WIDTH ONE-SHOT
(MODEL 145 ONLY)
PULSE OUTPUT BUFFERS
(MODEL 145 ONLY)
STOP/START
(MODEL 145 ONLY)
SYNC OUT BUFFER
PULSE MODE SW-5
PULSE WIDTH SW3-A
PULSE WIDTH SW3-B
PULSE DELAY SW2-B
GENERATOR MODE SW1-A
SW1-B
SW-4 MOM.
MANUAL TRIGGER
SW12
VARIABLE
NOT USED
E32
E33
E49 DETENT SW3
E50 DETENT SW2
E51 DETENT SW1
PULSE SELECT
PULSE
GND
PULSE DISABLE
SYNC OUT
TRIG IN
TRIG A
PI-1 SYNC
PI-4 TRIG LOGIC
PI-5
7407
74LS00
74LS08
74LS86
74LS74
74S140
74S132
74S74
1820-1197
SWL500
7411508
1820-1201
1. ALL DIODES ARE FD6666
3. ALL RESISTORS ARE 1/4W, 1%, MF
2. CAPACITANCE IN MICROFARADS
1. RESISTANCE IN OHMS
NOTE: UNLESS OTHERWISE SPECIFIED
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REMOVE ALL BURRS AND BREAK SHARP EDGES
MATERIAL
FINISH WAVETEK PROCESS
DRAWN D. COOPER 7-22-77
ENGR
MFG
TOLERANCES UNLESS OTHERWISE SPECIFIED XX ± .02 XXX ± .010 ANGLES ± 1°
DO NOT SCALE DRG
SCALE
WAVETEK SAN DIEGO • CALIFORNIA
TITLE SCHEMATIC TRIG/PULSE BOARD
MODEL NO. 145/145
DRWG NO. 0103-00-0565
REV A
SIZE D
CAGE 23338
SHEET 2 OF 2

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REV	ECN	BY	DATE	APP

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	ASSY DWG TRIG/PULSE	0101-00-0585	WVTK	0101-00-0585	1
NONE	SCHEMATIC TRIG/PULSE	0103-00-0585	WVTK	0103-00-0585	1
NONE	WHT,MEAT BLNK	182-305	WVTK	1400-00-5143	3
C27	CAP,CER;.10PF,1KV	00-100	CRL	1500-01-9011	1
C13 C15 C17 C2 C22 C24 C25 C26 C4 C46 C5 C64 C7 C9	CAP,CER,,.01MF,50V	CK-103	CRL	1500-01-9310	10
C30	CAP,CER,22PF,1KV	GU-220	CRL	1500-02-2011	1
C07	CAP,CER;.33PF,1KV	UD-330	CRL	1500-03-3011	1
C20 C51	CAP,MICA,220PF,500V	DM15-221J	ARCO	1500-12-2100	2
C21 C23	CAP,ELECT,1000MF,10V	500U10T001QC7	SPRAG	1500-31-0101	2
C1 C3	CAP,ELECT,1000MF,35V	5WU10B0035GL6	SPRAG	1500-31-0212	2
C10	CAP,ELECT,400UMF,15V	TC0402U015M1L	MAL	1500-34-0211	1
C14 C16	CAP,ELECT,5UMF,50V	500D5A050D0U7	SPRAG	1500-35-0803	2
C6 C8	CAP,ELECT,500MF,50V	3WU5075B50L6	SPRAG	1500-35-0103	2
C29 C61	CAP,TANT,22MF,15V	196D226X9015A1	SPRAG	1500-72-2601	2
C18	CAP,TANT,15MF,10V	150D156X9010D2	SPRAG	1500-73-3601	1
NONE	TRIGGER/PULSE	1700-00-0585	WVTK	1700-00-0585	1
A2P1	CONN,WPIN	09-56-7091	MOLEX	2100-02-0051	1

WAVETEK PARTS LIST — TITLE: PCA,TRIGGER/PULSE — ASSEMBLY NO: 1100-00-0585 — PAGE: 1 — REV: A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
R37	RES,MF,1/8W,1%,24.9K	RN55D-2492F	TRW	0701-03-2492	1
R23	RES,MF,1/8W,1%,3.32K	RN55D-3321F	TRW	0701-03-3321	1
R38?	RES,MF,1/8W,1%,392	RN55D-3920F	TRW	0701-03-3920	1
R26	RES,MF,1/8W,1%,3.92K	RN55D-3921F	TRW	0701-03-3921	1
R7 R8	RES,MF,1/8W,1%,6.75K	RN55D-6751F	TRW	0701-03-6751	2
R10 R16	RES,MF,1/8,1%,999	RN55D-9990F	TRW	0701-03-9990	2
R12 R14 R25 R34 R40	RES,MF,1/8W,1%,4.99K	RN55D-4991F	TRW	0701-03-4991	5
R28	RES,MF,1/8W,1%,6.19K	RN55D-6191F	TRW	0701-03-6191	1
R36	RES,MF,1/8W,1%,4.96K	RN55D-4981F	TRW	0701-03-4981	1
R24	RES,MF,1/8W,1%,8.25K	RN55D-8251F	TRW	0701-03-8251	1
R1 R2	RES MODULE	4816P-101-103	BOURN	0770-00-0008	2
R29 R30	RES,SIL,2-13%,1/8W GT7216781-23-1002	1K2-501-4A4	AVX	0789-05-0019	1
CR13	DIODE	1N4581	MICRO	6001-01-4581	1
CR1 CR10 CR11 CR12 CR2 CR3 CR4 CR5 CR6 CR7 CR8 CR9	DIODE	SCE-1	SEMTC	6001-02-0001	12
CR14 CR15 CR16	DIODE	FD-4448	FAIR	6037-02-4448	3
Q1 Q13 Q16 Q15 Q5 Q6	TRANS	2N3903	FAIR	6701-03-9030	6

WAVETEK PARTS LIST — TITLE: PCA,TRIGGER/PULSE — ASSEMBLY NO: 1100-00-0585 — PAGE: 3 — REV: A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	WIRE,HU,22GA	15W-WHITE/BROWN	GAVIT	6000-32-2491	2
NONE	WIRE,HU,22GA	15W-WHITE/RED	GAVIT	6000-32-2492	2
NONE	WIRE,HU,22GA	15W-WHITE/ORANGE	GAVIT	6000-32-2493	1
NONE	WIRE,HU,22GA	15W-WHITE/YELLOW	GAVIT	6000-32-2494	1
NONE	WIRE,HU,22GA	15W-WHITE/GREEN	GAVIT	6000-32-2495	1
NONE	WIRE,HU,22GA	15W-WHITE/BLUE	GAVIT	6000-32-2496	1
NONE	WIRE,HU,22GA	15W-WHITE/VIOLET	GAVIT	6000-32-2497	1
NONE	CABLE,CODE-26AWG	MC 176/U	ITT	6001-60-0001	1
IC1	IC	MC1458P	MOT	7000-14-5800	1
U9	IC	7824	FAIR	7000-78-2400	1
U10	IC	7924	FAIR	7000-79-2400	1
IC3 IC4	IC	74LS00	TI	8000-74-8010	2
IC6	IC	74C900	TI	8000-74-8619	1
IC2	IC	74L674	TI	8000-74-7410	1
U11	VOLTAGE REGULATOR	7805303	FAIR	8000-78-0500	1
IC7	IC	74S140	TI	8007-40-4001	1

WAVETEK PARTS LIST — TITLE: PCA,TRIGGER/PULSE — ASSEMBLY NO: 1100-00-0585 — PAGE: 5 — REV: A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
NONE	BKT,IC,14PIN	14-DIP	CINCH	2100-83-0011	1
NONE	BULDG LUG	1497	SMITH	2100-84-0012	2
NONE	PIN	08-50-0105	MOLEX	2100-05-0025	9
NONE	STANDOFF	P-4U9-440-FUS-440	WVTK	2800-02-5016	4
FB8	FERRITE BEAD	56-590-65/3B	FERRE	3100-00-0001	1
R27	POT,TRIM,1K	91AW1K	BECK	4600-01-0209	1
S02	POT,SWITCH,10K	GN-1079	CTS	4602-01-9300	1
K9	POT,CONT,10K FROM:4600-01-0312	4609-71-0303	WVTK	4609-71-0303	1
R11 W17	RES,C,1/2W,5%,6.7	RC20GF-6R7	STKPL	4700-25-0679	2
R9	RES,C,1/2W,5%,220	RC20GF-221	STKPL	4700-25-2200	1
R31	RES,C,1W,10%,10M	RC32GF-105	STKPL	4700-35-1002	1
R35 W41	RES,MF,1/8W,1%,100	RN55D-1000F	TRW	4701-03-1000	2
R13 R15 R20 R21	RES,MF,1/8W,1%,1K	RN55D-1001F	TRW	4701-03-1001	4
R39	RES,MF,1/8W,1%,1.5K	RN55D-1501F	TRW	4701-03-1501	1
R32	RES,MF,1/8W,1%,15K	RN55D-1502F	TRW	4701-03-1502	1
R33	RES,MF,1/8W,1%,1.78K	RN55D-1781F	TRW	4701-03-1781	1
R42	RES,MF,1/8W,1%,2.21K	RN55D-2211F	TRW	4701-03-2211	1

WAVETEK PARTS LIST — TITLE: PCA,TRIGGER/PULSE — ASSEMBLY NO: 1100-00-0585 — PAGE: 2 — REV: A

REFERENCE DESIGNATORS	PART DESCRIPTION	ORIG-MFGR-PART-NO	MFGR	WAVETEK NO.	QTY/PT
Q3 Q7 Q8	TRANS	2N3965	FAIR	4901-03-9050	3
Q4	TRANS	TIP-29	TI	4902-00-8290	1
Q2	TRANS	TIP-30	TI	4902-00-8309	1
SW1-A SW1-B	WAFER	147-400	WVTK	5104-02-0015	2
NONE	SWITCH ASSY	215-53-001-03-22	CTS	5104-07-3005	1
SW1	DETENT MOD FROM:5104-01-8010	5104-99-0031	WVTK	5104-99-0031	1
SW4	SWITCH,TOGGLE	7108P3S1B4VD	C&K	5106-00-0128	1
NONE	WIRE,HU,22GA	15W-BROWN	GAVIT	6000-32-2001	1
NONE	WIRE,HU,22GA	15W-RED	GAVIT	6000-32-2002	2
NONE	WIRE,HU,22GA	15W-ORANGE	GAVIT	6000-32-2003	2
NONE	WIRE,HU,22GA	15W-YELLOW	GAVIT	6000-32-2004	2
NONE	WIRE,HU,22GA	15W-GREEN	GAVIT	6000-32-2005	2
NONE	WIRE,HU,22GA	15W-BLUE	GAVIT	6000-32-2006	2
NONE	WIRE,HU,22GA	15W-VIOLET	GAVIT	6000-32-2007	2
NONE	WIRE,HU,22GA	15W-GRAY	GAVIT	6000-32-2008	2
NONE	WIRE,HU,22GA	15W-WHITE	GAVIT	6000-32-2009	2
NONE	WIRE,HU,22GA	15W-WHITE/BLACK	GAVIT	6000-32-2040	2

WAVETEK PARTS LIST — TITLE: PCA,TRIGGER/PULSE — ASSEMBLY NO: 1100-00-0585 — PAGE: 4 — REV: A

NOTE: UNLESS OTHERWISE SPECIFIED

REMOVE ALL BURRS AND BREAK SHARP EDGES
MATERIAL
FINISH: WAVETEK PROCESS
DRAWN
DATE
PROJ/ENGR
RELEASE APPRO
TOLERANCE UNLESS OTHERWISE SPECIFIED: XX ± .010, ANGLES ± 1°, XXX ± .005
DO NOT SCALE DWG
SCALE

WAVETEK SAN DIEGO, CALIFORNIA

TITLE: TRIGGER / PULSE

MODEL NO: 143
DWG NO: 1100-00-0585
REV: A
CODE IDENT: 23338
SHEET 1 OF 1